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MEDICAL AND SURGICAL REPORT

OF THE

PRESBYTERIAN HOSPITAL

IN THE

CITY OF NEW YORK

VOLUME VI
JANUARY, 1904

EDITED BY

ANDREW J. McCOSH, M.D.
W. GILMAN THOMPSON, M.D.

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THE BRIDDON MEDAL

CONDITIONS OF AWARD

1. This medal shall be known as the Briddon Medal.

2. This medal shall be awarded once in two years to that member of the Society of the Alumni of the Presbyterian Hospital who shall present the most meritorious essay on a medical, surgical, pathological, or bacteriological subject.

3. The award of this medal shall be made by a committee of three, consisting of the President, together with a member of the medical and surgical staffs of the Medical Board of the Hospital to be appointed by the President at the annual May meeting.

4. All essays shall be typewritten and forwarded to the Superintendent of the Hospital on or before October 1, prior to the award of the medal.

5. Each essay must be signed by some fictitious name or device, and must be accompanied by a sealed envelope containing this name or device together with the true name of the writer.

6. If, in the judgment of the committee, none of the competing essays is sufficiently meritorious, no medal shall be awarded; in such event the sum ordinarily expended for the purchase of such a medal shall be used for the purchase of standard medical works, to serve as a reference library for the house staff of the Hospital.

7. The medal shall not be awarded a second time to any member of the Society.

8. No member of the Medical Board shall compete for this medal.

9. The successful essay shall be published in the first number of the Presbyterian Hospital Medical and Surgical Report issued after the award of the medal.

10. No essay shall be submitted a second time in competition for this medal.

11. The first award of this medal shall be made in December, 1903, by the President of the Medical Board at the annual dinner of the Society.

NOTE.—Prize Essay will be found on page 71.

I.

DATA REGARDING ACUTE LOBAR PNEUMONIA.

Compiled from the Medical Histories of the Presbyterian Hospital.

By George A. Tuttle, M.D., and Herbert S. Carter, M.D.

The alarming prevalence of acute lobar pneumonia in all seasons of the year and in all periods of life from infancy to old age, and the front rank it has attained in mortality statistics as the cause of death, are facts which demand the most careful attention and study from the medical profession. Although the subject is old, and statistics are at hand from many sources, the importance of the disease is always new and present, and some facts of interest may be deduced from a review of a considerable number of cases which have been carefully examined and observed.

During a period of nearly six years, ending in February, 1903, 600 cases of acute lobar pneumonia were treated in the medical wards of the Presbyterian Hospital. In the same period the total number of patients admitted was 8,470. Acute lobar pneumonia, then, alone or in complication with other diseases, occurred in over seven per cent. of all the patients admitted. The number of deaths in which pneumonia figured as the primary or as a contributing cause was 209, in a total number of deaths from all causes of 1,305. So that of the primary and complicating cases of pneumonia 34.8 per cent. died, and of the entire number of deaths from all causes sixteen per cent. were due wholly or in part to this disease. The object of this report is not to exploit the results of this or that method of treatment in a selected number of cases, but to present the facts in regard to acute lobar pneumonia in whatever way it shows itself in a general hospital which receives its patients from a class of people in poor but fairly comfortable circumstances. Indeed, methods and results of the treatment of pneumonia can hardly be considered in hospital cases, which, as a rule, are first seen in an advanced stage of the disease. In the present series of cases the majority were admitted during the fifth day, after the initial symp-

toms. But the experience of this hospital may be taken as a fair index of the average experience of other hospitals in this city and in other large cities where similar conditions exist, and as a demonstration of the frequent occurrence and gravity of this disease.

Of the 600 cases here considered, 406 were males and 194 females. Of the males, 142, or 34.9 per cent., and of the females, 67, or 34.5 per cent., died. These figures are not to be taken as representing the mortality from acute lobar pneumonia alone in this hospital, but merely to show the gross mortality among all the cases in which pneumonia occurred. In another part of this paper these figures will be explained by enumerating the complicating conditions which may have contributed to a fatal termination, and the cases which were beyond medical assistance when admitted, and an attempt will be made to show the results obtained in the cases which may fairly be considered to have been affected by medical treatment.

The specific cause of pneumonia, the micrococcus lanceolatus, seems to be present always and everywhere; but the conditions which favor its entrance into the human body are more frequently brought about in this climate during the six months of winter and spring. Among these conditions are the frequent changes of temperature and atmospheric properties and the crowding together of people in ill-ventilated and otherwise unsanitary apartments of tenement houses. Four hundred, or exactly two-thirds of these cases, occurred in the six months from December to May inclusive. The following table shows the distribution of the disease by months and the mortality for each month:

Month.	Number of Cases.	Recovered.	Died.
January	71	45	26
February	51	33	18
March	82	62	20
April	60	39	21
May	49	31	18
June	41	32	9
July	22	13	9
August	24	11	13
September	32	16	16
October	40	23	17
November	41	32	9
December	87	54	33
Total	600	391	209

Enteric conditions in children and typhoid fever increased the mortality during the summer and early autumn.

The distribution of the disease according to age has been arranged for convenience by decades after the first year of life, infants under one year being classed by themselves, as seen below:

Age.	Number of Cases.	Recovered.	Died.	Per Cent. of Deaths.
Under 1 year	18	9	9	50
1–10	96	85	11	11.45
11–20	65	53	12	18.46
21–30	128	96	32	25.
31–40	105	70	35	33.3
41–50	69	38	31	43.48
51–60	69	25	44	63.76
61–70	31	11	20	64.51
71–80	8	3	5	62.5
Age not given	11	1	10	

Of the infants that died, six had gastro-intestinal disorder and one developed diphtheria. Among those that recovered, two had diarrhœa and the others had no complications. No attempt is made in the above table to exclude cases with complicating diseases, as it is found that they are so distributed as not to affect greatly the comparative results. It is interesting to note the steadily increasing mortality in each succeeding decade up to fifty years, and then a much higher but stationary mortality in the remaining three decades. The increasing frequency of complicating conditions explains to some extent the rising mortality. But besides the diminished resistance due to physical changes which accompany advancing years, occupation, habits of living and dress, and impaired nervous force caused by conditions other than physical, play an important part.

The right lung alone was affected in 301 cases; the left lung alone in 189 cases. Portions of both lungs either simultaneously or one after another were affected in eighty-two cases. In twenty-eight patients the location of the disease was not recorded. Although it is probable that there were some minor errors of observation as to the precise portion or lobe of lung involved, it may be of interest to tabulate the recorded observations in these cases.

Portions of Lung involved.	No. of Cases.	Mortality.
Right Lung—		
Upper Lobe	38	27 per cent.
Middle "	36	31.4 "
Lower "	56	36 "
Upper and Middle Lobes	46	31.9 "
Middle and Lower "	73	19.4 "
Upper and " "	2	
All three Lobes	50	42.8 "
Left Lung—		
Upper Lobe	36	24.3 "
Lower "	126	27 "
Both "	27	26 "
Both Lungs—	82	51.8 "
Right Upper and Left Upper Lobes	1	
" " " " Lower "	9	
" " " " Upper and Lower Lobes	1	
" Middle " " Upper Lobes	2	
" " " " Lower Lobes	8	
" " " " Upper and Lower Lobes	1	
" Lower " " Upper Lobes	3	
" " " " Lower "	13	
" Upper and Middle, and Left Upper Lobes	2	
" " " " " " Lower "	5	
" Middle and Lower " " Upper "	1	
" " " " " " Lower "	18	
" " " " " " Upper and Lower Lobes..	3	
" All Lobes and Left Upper Lobe	3	
" " " " " Lower "	7	
All Lobes	5	

There is probably some anatomical reason for the greater frequency of pneumonia in the right lung. The right bronchus is larger than the left one and is not much more than half as long. Dr. Andrew H. Smith mentions this as a probable factor in the explanation, and notes the tendency of foreign bodies to lodge in the right bronchus. It is possible that a slight difference in the circulation also favors the left lung. The left branch of the pulmonary artery preserves more nearly the direction of the main trunk, while the right branch makes a sharp bend to reach the lung. The right pulmonary veins also are longer than the left ones, and have to pass behind the right auricle to reach the left auricle. In valvular disease of the heart, especially in the failing compensation of mitral insufficiency, hydrothorax is liable to develop, and, as Osler says, it is usually on the right side. The same cause which

determines the development of hydrothorax may contribute to determine the development of pneumonia more frequently in the right lung. And when from any cause the right chambers of the heart are distended, it is probable that the return circulation from the right lung is more embarrassed than that from the left.

It may be well, at this point, to divide the cases into the following groups to show the variety of conditions included in this list and to explain to some degree the gross mortality of 34.8 per cent.:

1. Those who defervesced within twenty-four hours after admission to the hospital and required no medical treatment—68 cases.

2. Those who were *in extremis* when admitted, and died within twenty-four hours—69 cases.

3. Cases which may be classed as terminal, occurring in the course of fatal diseases—10 cases.

4. Those who were admitted after defervescence for delayed resolution—10 cases.

5. Simple pneumonias without complications which were treated two or more days in the hospital—297 cases.

6. Those in whom complications developed in the course of the disease—64 cases.

7. Those who had other diseases independent of pneumonia and were treated in the hospital two or more days—82 cases.

Some of the patients in the first group received cold packs or other external applications, but none of them was alarmingly ill. Some cases of cardiac and renal diseases are noted among them.

The cases in the second group include many with serious complications. Whether it is wise to transfer such cases to the hospital is a grave question. Some of the patients included in this group died within three hours after their arrival.

The group of terminal pneumonias includes two cases of chronic nephritis; one of typhoid fever; one of gastro-enteritis with erysipelas; one of stricture of the œsophagus; one of appendicitis with perforation; and four cases of malignant new growths—carcinoma of liver and spleen, of œsophagus, and of stomach, and sarcoma of the kidney.

The cases without complications of any kind were 297 in number, and of these sixty-eight, or 22.8 per cent., died. Most of the deaths were ascribed to toxæmia or œdema of the lungs. A few cases of rapid heart failure and of hyperpyrexia were noted, and a few were described as due to asthenia.

The complications which were directly consequent to pneumonia are here tabulated, with the number of cases and the number of recoveries and deaths from each.

Complications.	Number of Cases.	Recovered.	Died.
Laryngitis, Acute	3	2	1
Bronchitis, General	2	1	1
Gangrene of Lung	1		1
Gangrene of Lung, Pericarditis	1		1
Abscess of Lung, Pericarditis, Nephritis	1		1
Pleurisy with Effusion	10	9	1
Empyema	18	17	1
Pericarditis, Dry	5	1	4
Pericarditis with Effusion	3	3	
Tachycardia, Paroxysmal	1		1
Endocarditis, Malignant	1		1
Delayed Resolution	1		1
Otitis media	5	4	1
Nephritis, Acute	3	2	1
Delirium Tremens	4	1	3
Embolism, Cerebral	1		1
Thrombosis of Suprarenal Artery	1		1
Hemorrhage, Intestinal; Phlebitis, Femoral	1	1	
Miscarriage; Septicæmia	1		1
Nephritis, Acute, and Pleurisy with Effusion	1		1
Total	64	41	23

The last group comprises eighty-two cases in which pneumonia occurred in the course of acute or chronic diseases. Some of these cases had complications, apparently due to the pneumonic process in addition. The variety of conditions encountered in this group of cases is seen in the following list:

Diseases.	Number of Cases.	Recovered.	Died.
Endocarditis, Chronic	9	4	5
" " Mastitis	1	1	
" " Nephritis, Chronic	1	1	
" " Cerebral Embolism	1		1
" " Pericarditis, Acute	3	3	
" " Rheumatism, Acute; Pericarditis with Effusion	3	1	2
Endocarditis, Chronic; Rheumatism, Acute; Pleurisy with Effusion	1	1	
Endocarditis, Chronic; Rheumatism, Acute; Pericarditis and Pleurisy with Effusion	1		1
Endocarditis, Chronic; Cirrhosis of Liver	1		1
Myocarditis	1		1
Hypertrophy of Heart, Arterio-sclerosis	1		1
Arterio-sclerosis	1		1
Nephritis, Chronic	8	5	3
" " Diabetes Mellitus	1		1
" " Arterio-sclerosis	1		1
" Subacute	1	1	
Tuberculosis of Lungs	2	1	1
" " " Miscarriage	1	1	
Gastro-enteritis and Enteritis	9	4	5
Erysipelas, Alcoholic Dementia	1	1	
"	1	1	
Rheumatism, Acute	2	2	
Typhoid Fever	9	4	5
" " Empyema	1	1	
Malaria, Tertian	2	2	
" Æstivo-autumnal	1	1	
Spondylitis, Tubercular	1		1
Colitis, Acute	1	1	
Pregnancy	1	1	
Neuritis, Multiple	1		1
" Alcoholic	1		1
Spleno-megale, Jaundice	1	1	
Cholecystitis, Gummata of Liver	1		1
Septicæmia	1		1
" Puerperal	1	1	
Lateral Sclerosis	1	1	
Pyelitis	1	1	
Diphtheria	1		1
Asthenia	1		1
Arthritis, Septic; Thrombosis	1	1	
Insolation	1		1
Whooping-cough	1	1	
Cirrhosis of Liver, Jaundice	1	1	1
Pernicious Anæmia	1		1
Total	82	43	39

Comparing the last three groups of cases described above, the mortality resulting from pneumonia without complications was 22.8

per cent.; when accompanied with complications, it was almost 36 per cent.; and when in connection with other diseases, it was 47.5 per cent.

Thirty-three patients contracted pneumonia in the hospital while under treatment for other diseases.

A simple enumeration of all the diseases or lesions met with in connection with pneumonia shows that seventy-six distinct diseases or complications occurred in the aggregate two hundred and ninety-one times. This number does not represent individual cases, as two or more of these lesions may have been present in the same patient.

The symptoms which marked the invasion of the disease were recorded in 561 cases. In 282, or approximately one-half of the cases, there was a distinct chill, or in a few cases repeated chills.

Chilly sensations were noted in sixty-three cases; fever in ninety-seven; pain in thirty-eight; vomiting in thirty-nine; cough in eleven; general malaise in ten; convulsions in nine; headache in two; vertigo in two; prostration in four; an indefinite gradual invasion in two; earache and dyspnœa in one case each.

Of those who recovered, the temperature fell abruptly to the normal in 161 cases, and by a gradual decline to normal in 184 cases. The days of the disease on which the crises occurred, and the days on which the temperature began to fall by lysis, with the number of cases for each day are here tabulated; also the days on which the deaths occurred:

Days of Disease.	Crises.	Lyses.	Deaths.
2	1		3
3	4	2	4
4	4	3	14
5	15	10	14
6	16	15	21
7	20	30	26
8	27	33	25
9	20	28	25
10	17	18	11
11	6	9	6
12	2	12	14
13	4	4	1
14	3	9	3
15	1	2	3
16		2	
17		4	
18	1	3	1
Total.....	161	184	171

The cases tabulated above are 516 in number, and of these 391 terminated in recovery or death between the fifth and tenth days of the disease inclusive. It is to be noted that these figures do not show any marked tendency of the disease to terminate especially on the fifth, seventh, and ninth days. But approximately one-half of these cases ended in convalescence or death on the seventh, eighth, and ninth days. One case is recorded as having defervesced by crisis on the second day of the disease. It is perhaps unfair to include this as a case of genuine lobar pneumonia. The history would indicate that it was probably an abortive pneumonia. The patient, a woman twenty-five years of age, began to be ill, with chilly sensations, cough, and pain in her right side. On the following day she was admitted to the hospital with a temperature of 105°. There was marked dulness to percussion over the right lower lobe and many fine râles were heard over this area. With rapid pulse and respiration, cough, pain in the side, and high temperature, she presented the appearance of pneumonia in an early stage. Strapping was applied to the side, and within twelve hours the temperature fell to the normal and remained there. The physical signs disappeared in a few days. Bronchial voice and breathing were not present at any time, and probably the process did not pass the stage of congestion. Four cases defervesced on the third day. Two of these were typical cases of uncomplicated pneumonia, starting with a chill and presenting all of the characteristic symptoms, rusty sputum, physical signs, etc. One was in a case of typhoid fever, in a late stage of the disease; and one was a case of chronic endocarditis in which pneumonia of the middle lobe of the right lung developed with a chill, high temperature, and bloody expectoration. Convalescence began with an abrupt fall of the temperature on the third day. The occurrence of the crisis on the third day is uncommon, and before the third day it is very rare.

One or more leucocyte counts were made during the progress of the disease in 354 cases. Some degree of leucocytosis is the rule in pneumonia. In only ten per cent. of these cases did the number of leucocytes not exceed 10,000 per cubic millimetre. The average number of leucocytes in 236 cases which recovered was 20,600, and in 118 fatal cases it was 19,500. From these figures it appears that as a prognostic factor the presence of leucocytosis has little value. The absence of

leucocytosis, on the other hand, in a severe case is of grave import. Some evidently mild cases with a limited involvement of lung and almost no intoxication have slight or no leucocytosis. Among the 236 cases which recovered, the leucocytes did not exceed 10,000 in only seventeen, or about seven per cent., and they did not exceed 12,000 in forty, or seventeen per cent. Of the fatal cases, nineteen, or sixteen per cent., had a leucocyte count of 10,000 or less, and twenty-six per cent. did not exceed 12,000 leucocytes. It is probable that a very high leucocytosis also may be an unfavorable sign. Of the 118 fatal cases, five showed a leucocytosis of more than 50,000, while only one in the 236 that recovered exceeded this number.

Gastro-intestinal disturbances in the course of the disease increase the discomfort of the patient, and if persistent, may add to the danger and exhaustion from the disease. More or less vomiting is recorded in 120 cases, and among these there were forty-three deaths. Holt says "the development of vomiting or diarrhœa late in the disease is unfavorable, especially in infants." Tympanitic distention of the abdomen is also a serious complication. Whether due to a paretic condition of the intestinal walls produced by the toxæmia, or to the decomposition of food of improper quality or too great in amount, it mechanically impedes both respiration and heart action. And whether it is the cause or the result of the serious condition of the patient, its presence is an unfavorable sign, unless it is soon relieved by treatment. Abdominal distention of sufficient importance to be recorded occurred in thirty-seven cases, of which sixteen died.

The examination of the urine shows that albumin is present during the disease in a majority of the cases. The recorded observations in 510 cases show the presence of albumin in 392, the remaining 118 cases being normal. In 256 cases the amount of albumin is expressed as a trace, which is a common finding in many acute febrile diseases, and is generally of little or no importance. In 136 cases the amount of albumin is expressed in percentages, roughly approximated, the average being ten per cent. Of these, sixty-six, or almost one-half, died. Among the complications recorded in the histories are thirty-three cases of nephritis, and of these only seventeen were really under treatment in the hospital. Four are recorded as acute, one as subacute, and twelve as chronic nephritis. According to the hospital records it is evident

that in a majority of these 136 cases the condition was regarded as transient albuminuria. Certainly, the prompt disappearance of even large amounts of albumin in many cases during convalescence favors this view. But the high mortality among these cases warrants the conclusion that a marked albuminuria, even without distinct signs of nephritis, is to be regarded as an unfavorable indication.

In regard to pneumonia in alcoholic subjects, the records are of rather doubtful value. It is often difficult to determine, from the statements of the patients, how to classify them. Many, while admitting the fact of using alcohol, conceal or do not realize the extent of their indulgence. Between moderate occasional or habitual use and excessive occasional or habitual use there are wide differences in the opinions of different individuals, even when they are willing to tell the truth. Nevertheless, it may be of interest to classify the cases according to the statements recorded in the histories and let the figures speak for themselves. It is found in this way that the cases are divided into four classes: the markedly alcoholic, the moderately alcoholic, the doubtful or unknown, including those whose appearance and symptoms belied their statement, and those who were unable from their condition to testify; and the non-alcoholic. Ninety-two cases were recorded as markedly alcoholic, and of these, forty-three, or 46.7 per cent., died. One hundred and sixty-nine were classed as moderately alcoholic, and of these, fifty-six, or thirty-three per cent., died. The doubtful or unknown were 102 in number, with a mortality of 61.7 per cent. Many of these were *in extremis* when admitted, and died soon after. The remainder—237 in number—were pretty certainly non-alcoholic, and among these the mortality was just under twenty per cent. Even allowing for some inaccuracies in the patients' statements, these figures copied from the records are significant and instructive.

Treatment.—As long as there is no specific remedy or antitoxin applicable in all cases, the treatment of acute lobar pneumonia must be entirely symptomatic and hygienic. Strümpell says: "Most cases get well under, or we can almost say in spite of, any treatment." "We do not know a remedy which can in any way exert a favorable influence upon the pneumonic process itself." The main indications are, to support life until the disease has run its course, and to relieve the sufferings of the patient by means which disturb as little as possible the

functions of the various organs. Osler says: "The young practitioner may bear in mind that patients are more often damaged than helped by the promiscuous drugging which is still only too prevalent." The fact that in young children and in vigorous healthy adults in good hygienic surroundings the tendency of the disease is toward recovery with almost no medical treatment, is significant of much in the general care of this disease. A death rate of only 3.6 per cent. in over 40,000 cases in the German army, as mentioned by Osler, is an instructive illustration. The above facts should be borne in mind in estimating the probable value of any plan of treatment which includes or consists chiefly in the administration of a certain drug for a specific effect upon the disease. Such plans are now and again published and commended by the authors on the strength of their own successful experience, and they are often tried by others, perhaps in different external conditions, or among a different class of patients, with disappointing results.

The patients admitted to the wards of a city hospital for pneumonia present other problems almost as various as the individual cases. Besides the many visible or easily detected signs of disease or constitutional weakness, there may be under a fairly vigorous exterior a serious physical or nervous affection produced by a secret drug or alcoholic habit, or by excesses in other directions. Or again, and not infrequently, the patients are debilitated by want or by improper food. Thus there can be no uniform plan of treatment such as might be practised among a class of patients on more even terms, as the German soldiers mentioned above. Absolute rest and quiet in good hygienic surroundings from the beginning of the disease are very important. These patients, after about four days of illness at home, in crowded tenement houses for the most part, are brought to the hospital. The excitement and more or less exertion attending the transfer at this stage of the disease, cannot but be detrimental to those who are seriously ill. And sometimes the exaggeration of symptoms produced in this way may give a wrong impression of the actual condition and lead to the use of measures which might better be omitted. The treatment of pneumonia in these circumstances is often unsatisfactory and sometimes discouraging.

More than twelve per cent. of the entire number of patients received no medical treatment whatever. The therapeutic measures generally

employed were purely symptomatic, but in a moderate number of cases special drugs for a certain specific purpose were used in addition.

For the relief of the pleuritic pain, external applications were largely used. Straps of rubber plaster applied firmly to the affected side to restrict the movement of the ribs often gave decided relief. The hot-water bag or poultice and the ice-bag and ice-poultice were much used. These measures should be given a fair trial, and only when they do not sufficiently relieve the pain should opium or morphine be given. It seems to the writers that in mild cases of pneumonia without toxæmic symptoms but with pronounced pain, the use of morphine does no harm and is often beneficial. But in severe cases, with profound toxæmia, it should be used, if at all, with the greatest caution. A physician of more than average ability whose practice is in a small manufacturing town, once told the writer that since he had discarded the use of morphine in the treatment of pneumonia, his success had been decidedly greater. He was led to do this by learning that a rival practitioner who had acquired a local reputation for success in treating this disease, did not prescribe this drug. Morphine was used to some extent in about one-fifth of all the hospital cases, and many times apparently with decided benefit. In conditions of restlessness or active delirium which threaten to exhaust the patient's strength, a full dose of morphine is sometimes of great value. But taking the records as they stand, without analyzing the cases, more than fifty-seven per cent. of the patients who received morphine died.

For the reduction of temperature, cold packs applied to the chest alone or to the whole body were found to be of great value. Alcohol sponge-baths, or sponging with tepid water, were also frequently used with good effect. Rarely a full bath at about 80° was given. No antipyretic drugs were used at any stage of the disease.

Dyspnœa was relieved by dry cupping in many cases. Sometimes the relief was only slight and temporary, but often the effect was decided and grateful. Turpentine stupes and poultices, with and without mustard, were many times beneficial. Phlebotomy was tried in a few instances, but only twice with lasting benefit. Strychnine was given in most cases. For pleuritic dyspnœa alone the cold applications mentioned above were sometimes preferable.

Some degree of cyanosis at some stage of the disease was commonly

noted in the records. When slight, and not persistent or increasing no special treatment was employed. But for marked and increasing cyanosis, in addition to other measures, oxygen was administered at frequent intervals, and sometimes almost continuously for several hours. The records show that oxygen was used to some extent in 134 cases. A number of these were *in extremis* before the inhalations were given, but in many the inhalations were begun fairly early in the disease. Thirty-five of these patients recovered, and among them were fourteen double pneumonias, and in seven others an entire lung was involved. Of those who died, twenty-four had double pneumonia, and an entire lung was affected in sixteen others. Many times oxygen improved the appearance of the patient and seemed to afford relief. As an adjuvant to other measures it may be of great value when a large area of lung is involved, if its use is not too long delayed.

The gradual or sudden failure of the heart is, perhaps, in most cases, the greatest danger of pneumonia. In addition to the extra labor imposed upon the right auricle and ventricle, it is weakened by the deficiency of oxygen in its blood supply and by the poison of the disease, and it is mechanically impeded by the hard and swollen lung. Absolute rest in bed and the avoidance of any exertion on the part of the patient are of great importance. Equally important also is the avoidance of any medication which is liable to further depress the heart or increase its labor, or interfere with the elimination of the toxins. After a careful study of the stimulating medication used in the various cases it is difficult to arrive at any definite conclusions. Certain patients who were exceedingly ill, with a large area of lung involved, recovered after the use of cold packs with practically no stimulation. Others who were very ill, with only a small area of lung involved, required or received a multiplicity of stimulating drugs without relief. It seems to the writer that each individual case is to be treated according to the discrimination, judgment, and experience of the physician in charge; and experience inclines us to have more confidence in nature and less in drugs. It is found, from the records, that whiskey (sometimes brandy) was the most often used, and apparently the most valuable, stimulant. Next to this, strychnine was most relied upon. One hundred patients received no stimulation whatever, and of these, eighty-two received almost no medical

treatment. Rest in bed and in some cases external applications were all that was required. Two hundred and fifty-seven patients received either whiskey or brandy or strychnine alone, or both strychnine and whiskey or brandy. Of these, twenty-six, or about ten per cent., died. Many serious cases are included in this number, some with double pneumonia, and some with severe complicating diseases. The amount of stimulation required, however, was moderate, and the doses were usually supporting rather than stimulating. Fifty-four cases are noted in which digitalis was used in addition to strychnine and alcohol. Many of these were severe and complicated, but a considerable number were apparently simple pneumonias in good subjects. Of this number twenty-four died. We have thus accounted for 411 patients, of whom fifty died. The remaining 189 patients include many whose treatment as pneumonias it is unfair to consider. But many cases among them were simple pneumonias which seemed to require more active stimulation. Besides the agents already mentioned, nitroglycerine, strophanthus, convallaria, caffein, ammonia, atropine, and camphor and ether were used to some extent in certain cases. Of these, nitroglycerine is considered below.

Hypodermoclysis was given, sometimes only once and sometimes repeatedly in ninety-four cases. In all of these the heart was showing decided signs of weakness, and many of them were *in extremis* when admitted to the hospital. A large majority of these patients appeared to be in a desperate condition before they received this treatment. At the same time they were being vigorously stimulated with one or more of the drugs mentioned above. In these circumstances it is difficult to estimate the real value of this measure in the treatment of pneumonia. Usually the volume of the pulse was temporarily increased and the heart sounds improved. Only fifteen of these patients recovered, and some received the treatment before the final stage. In a few the improvement was striking, and was apparently the result of the treatment. In some of the fatal cases life appeared to have been prolonged in this way, and in a self-limited disease like pneumonia this is extremely important. The amount of solution used at one time varied between 500 c.c. and 1,500 c.c., and the largest number of hypodermoclyses given to one patient was seven.

Phlebotomy, sometimes followed by infusion, was performed in

sixteen cases, with two recoveries, which appear to have been directly due to this procedure.

Enteroclysis, with a view to stimulating the activity of the kidneys and increasing the elimination of the toxins, was frequently given.

A considerable number of the cases in our list received special medication in addition to the ordinary symptomatic treatment. These arrange themselves into six groups according to the different plans of treatment. Five of these groups are too small to warrant more than passing mention. In none of them are the cases selected, but each represents all of the cases admitted for a certain period.

1. Nitroglycerine. Although nitroglycerine was used in many cases for a special indication, and in desperate conditions in which everything was tried, it was used in twenty-nine cases throughout the disease to relieve the heart by dilating the arterioles and increasing the peripheral circulation. This group includes many serious diseases in connection with pneumonia, so that the value of this remedy can hardly be properly estimated. The ten cases which resulted in recovery included one double and five single pneumonias, one with empyema, one with nephritis, and two with both endocarditis and pericarditis. The nineteen fatal cases included four double and eight single pneumonias and seven with other serious diseases, chiefly of the heart and kidneys. The writer has used nitroglycerine in the course of certain cases of pneumonia with apparent benefit, but as a routine treatment its use does not seem to be warranted.

2. Sodium and ammonium salicylate were used in a very few instances, but with disappointing results. Published reports of seventy-two cases without a death and seventy-five cases with one death in a case of cardiac disease, all treated with sodium salicylate gr. x every two hours, would seem to indicate that this drug may have a specific effect upon the disease. Possibly the treatment should be started very early in the disease to get the best results, and hospital cases do not often permit of this. Of nine cases which received this treatment in the hospital, six died.

3. Potassium iodide in large doses frequently repeated was tried in thirteen cases, with two deaths.

4. Tincture of iodine in small doses well diluted was given in nine cases, with three deaths.

5. Carbolic acid with glycerine, largely diluted, was given in seven cases, with one death. Among these were two cases of chronic nephritis which terminated favorably.

6. Creosotal was given a more extensive trial, and the results seem to favor its use. In addition to the ordinary symptomatic treatment, the routine administration of creosotal ℥. x every two hours was begun and continued throughout the disease in 114 cases. Thirteen of these patients, only one of whom (with stricture of the œsophagus) died, are excluded as unfair, defervescence occurring soon after admission to the hospital. This group, therefore, consists of 101 cases, and of these, sixteen ended fatally. Among the eighty-five cases with recovery were eighteen with complicating conditions, and one double pneumonia. Pleurisy with effusion occurred five times; empyema, three times; acute rheumatism, twice; endocarditis, alone and with acute rheumatism and pleurisy with effusion, twice; pericarditis with effusion, acute nephritis, erysipelas, and pulmonary tuberculosis, once each; miscarriage and the puerperal state, twice. The sixteen fatal cases included two with double pneumonia, two with chronic nephritis, three with enteritis, chronic endocarditis, and acute pericarditis, one with both endocarditis and pericarditis, and one with pulmonary tuberculosis. The writer has had no experience in the use of creosotal, and is not prejudiced in its favor. But the routine administration of this remedy seems at least not to have been detrimental in these cases, and the mortality is below the average for all of the uncomplicated pneumonias mentioned above. In what way, if at all, creosotal is beneficial in pneumonia the writer is unable to state, but a mortality below sixteen per cent. in a series of cases such as a city hospital receives, is certainly in favor of its further trial.

To sum up the general impressions gained from the study of the treatment of these cases, the writer would place first in importance what are called "remedial measures other than drugs," which tend to spare and relieve and support the heart while the disease is running its course. Among these are absolute rest and quiet, with an abundance of fresh air; the administration of liquid food in small amounts, except in the aged and debilitated, who require more nourishment; the drinking of water or the use of hypodermoclysis or enteroclysis to increase the elimination of the toxins; cold packs or sponge-bathing to reduce

temperature, and for the tonic effect upon the circulation and the nervous system; and external applications to relieve pain and dyspnœa. These measures are to be supplemented by the judicious use of sedative, anodyne, and tonic or stimulating drugs, as required in individual cases. In the more serious cases which require stimulation during the course of the disease, the character and amount of the drug or drugs selected should be such as to support the heart and not to stimulate it to exhaustion before the disease has run its course. In only a very few cases did the writer gain the impression that the element of time and the stage of the disease were not sufficiently considered in the administration of stimulants.

No account is taken in this report of the cases of broncho-pneumonia treated in this hospital, of which many are found in the records during this period. The frequency of the pneumonias and the high mortality resulting therefrom in spite of any treatment suggest the importance of studying the possibility of preventive measures. Much has been done in regard to the contagious diseases and diphtheria, tuberculosis, and typhoid fever. But pneumonia, which is probably to some extent infectious and causes more deaths than any one of these, has received little attention. The education of the people in regard to personal cleanliness and hygiene and the care of the mouth and throat, and the strict enforcement of existing regulations for tenement-house sanitation, against crowding and against expectoration in public places, are measures which in our large cities, at least, might lessen the danger of contracting pneumonia. Other factors of more or less importance are mouth-breathing, coughing, and the careless use of soiled handkerchiefs in crowded cars and public assemblies.

II.

THE BEHAVIOR OF THE COSTAL ARCH IN DISEASES OF THE ABDOMINAL ORGANS AND ITS IMPORTANCE AS A DIAGNOSTIC SYMPTOM.

By Ellsworth Eliot, Jr., M.D.

The costal arch, composed of the consecutive portions of the seventh, eighth, ninth, and tenth costal cartilages, extends from the lower extremity of the sternum in front obliquely downward, outward, and backward, parallel to the surface of the body to the apex of the tenth rib behind. It serves as a connecting link between the corresponding ribs and the sternum, thus completing the wall of the lower part of the thoracic cavity. The spaces intervening between the individual cartilages are composed of the same structures as in an intercostal space, namely, of muscles and of fascial layers attached above and below to the borders of the respective cartilages. To their surfaces, as well as to their connecting ribs, are attached in addition the diaphragm, and, in general, the upper portions of all the muscles of the abdominal wall.

Although, in a strict anatomical sense, the lower border of this arch forms in front and laterally the corresponding most dependent portion of the thoracic cavity (which, posteriorly, descends still farther to the level of the twelfth rib), it nevertheless practically forms as well a segment of the upper anterior portion of the abdominal wall, corresponding to that portion of the cavity in which very considerable portions of the liver, spleen, and kidneys, and a moderate segment of the stomach are situated; in fact, the lateral portions of the liver and spleen are in places separated from the costal arch only by a very thin partition of diaphragm, pleural cavity, and lung. The extension upward in this way of the abdominal cavity above the lower level of the costal arch is readily accounted for by the well-marked concavity of the dome-shaped diaphragm.

Participating, therefore, in the formation of the walls of both the thoracic and abdominal cavities, and serving as well for the attachment and support of the abdominal muscles, it is not at all surprising that the costal arch should be materially affected by pathological conditions of contiguous organs.

In the normal state, the costal arch participates in the respiratory movements of the chest and abdomen, being slightly elevated during inspiration and lowered during expiration. This excursion can be prevented during quiet respiration by the gentle pressure of the examiner's hand; in fact, in any part of the respiratory cycle, with the patient in the recumbent position and breathing quietly, the costal arch can, in all of its different segments, be forcibly pressed into the abdominal cavity a variable distance, according to the degree of its inherent elasticity. Thus, its sternal extremity—composed entirely of cartilage, and supple, as well, in virtue of its intercartilaginous joints—can be depressed a greater distance than its posterior segment, which is more rigid because of the firm ribs with which the cartilages articulate. Again, the arc of excursion gradually diminishes as the patient grows older, due to calciferous degeneration and the resulting solidification of the costal cartilages and the not infrequent obliteration of their joints. In the healthy young adult, the completion of ossification in the contiguous ribs accounts for the fact that the movement of the costal arch is not as extensive as it is in children, although it is very much more extensive than in elderly people.

This normal excursion of movement of the costal arch is frequently disturbed, and this is true not only of its active respiratory movement, but more especially of that passive movement toward the abdominal cavity which it may be made to describe through the pressure of the examiner's finger. Interference with its active respiratory movement is elicited by inspection and is manifested chiefly in asymmetry of expiration, the less extensive expiratory recoil of the affected side being checked in a purely mechanical way, before it has been fully completed, by the presence of underlying neoplastic or inflammatory matter. In these cases the pathological condition must be painless, or, at all events, the pain, if present, must not be intensified by respiration, for in painful conditions the resulting involuntary inhibition of respiratory movement affects both costal arches alike, irrespective of the

side on which the inflammatory focus is situated, and no criterion of comparison exists. Hence asymmetry of the elastic recoil of the costal arch is to be observed chiefly in contiguous neoplasms and cysts, and in inflammatory conditions only after the subsidence of the acute and subacute stages and their associated pain and tenderness has taken place. Under these circumstances, accumulations of pus, as in "cold" abscess, may interfere with the recoil of the overlying arch.

Any change in the passive movement of the arch can be detected naturally only by palpation, and in eliciting this symptom, not only should the nature or character of its resistance to the surgeon's finger be determined, but one should observe as well whether the resistance is participated in equally by the entire arch or is most marked in one of its segments. In both normal and pathological conditions the degree of what may be called the "costal resistance" can be roughly estimated by the distance which the costal arch may be made to traverse through the moderate pressure of the examiner's fingers. The examination should always be conducted with the patient in the dorsal position, and the abdominal muscles should be relaxed as far as possible by flexion of the thighs and by directing the patient to breathe quietly, with the mouth slightly open. The degree of costal resistance is then best ascertained by placing the extremities of the second, third, and fourth fingers of either hand, respectively, on corresponding segments of the costal arches. Quick but gentle pressure is then made simultaneously, during expiration, in a direction toward the vertebral column, and any difference in the degree of mobility of either arch carefully noted. Proceeding downward and backward from the sternum to the tenth rib along the lower border of the costal arch, successive segments are then compared with each other and the presence of costal resistance in any segment readily determined. In case of bilateral costal resistance, symmetrically developed, pressure exerted simultaneously on the costal arches would decrease the distance between them to a very much less extent than is normal.

By a similar procedure, the relative resistance of the different segments of one arch may be ascertained, and any unusual deviation from the normal condition detected without comparing the affected segment with the corresponding segment of the opposite side. In this connection, however, the greater normal elasticity of the sternal ex

tremity must not be forgotten, and the desirability of supplementing the examination by a comparison of the abnormal with the normal side cannot be too greatly emphasized.

Under normal conditions, either costal arch may be depressed in this manner a very appreciable distance, and it may be roughly stated that in children, especially near the sternal extremity, this distance is somewhat greater than an inch; in adults, as the vertebral extremity is approached, between one-half and three-quarters of an inch, while in old people the distance decreases considerably less than one-half an inch.

On the other hand, in pathological conditions, both the character and degree of costal resistance vary very widely. Thus the resistance is of a hard, unyielding nature in the presence of underlying neoplasms, the sensation here imparted not differing materially from the sensation imparted by the palpation of a similar immovable growth on the exterior of the body; in a general way, it may be described as "board-like" in quality, and is not in any sense of the word elastic. In the presence of an acute or subacute inflammatory process, however, the costal resistance is very highly elastic, and the excursion of its movement very considerably limited. In the early stages of such a condition, before the formation of exudate, the increased resistance presented is due to more or less complete immobilization of the costal arch through the reflex contraction of its attached muscles. Subsequent exudation of serum or pus still further increases the pre-existing costal rigidity, and diminution is observed only after subsidence of the acute stage has taken place.

It is very important to emphasize, that asymmetry of costal resistance may be detected when there is no marked difference in the respiratory movement of the costal arches. Thus, as has previously been mentioned, in all acute inflammatory conditions of adjacent organs, the involuntary inhibition of the respiratory movement of the costal arch affects both sides alike. The difference in the costal resistance in a case of this character is, however, easily appreciated, and only in those instances (which must be very rare) in which the pathological process is symmetrically developed in the upper half of the abdominal cavity could any difficulty in eliciting this symptom be encountered.

Increase in costal resistance may or may not be associated with

tenderness on pressure. Resistance due to the presence of neoplasm may usually be detected without pain or discomfort to the patient. On the other hand, pressure on the affected segment of the costal arch in adjacent inflammatory conditions almost invariably elicits tenderness if the process be acute, and occasionally in chronic cases as well.

The behavior of the costal arch in the presence of painful inflammatory conditions in the lower half of the abdominal cavity sometimes

Method of eliciting rigidity in lower part of arch, *e.g.*, kidney.

deviates from the normal. In these cases, respiration is involuntarily largely thoracic, and the abdominal muscles are held motionless in order that there may be the least possible displacement of the inflamed organ. This accordingly results in a symmetrical decrease of the costal respiratory movement, and, on palpation, a corresponding symmetrical increase of the costal resistance may be observed, although it is usually not well pronounced. Notwithstanding, however, that inflammatory

processes in the lower half of the abdominal cavity are not generally associated, in their early stages, with any appreciable change in the degree of costal resistance, subsequent extension upward, should it occur in any instance, will result in the gradual development of this resistance as soon as the inflammatory process approaches a costal arch. In these cases the manifestation of this symptom serves a most useful purpose, not only as an indication for immediate operative interference, but also as a guide to that part of the abdominal cavity in which the inflammatory process is most rapidly extending, and to which the surgeon's efforts should be energetically directed.

Case I.—P. J. H.; male, aged thirty-three; admitted to the Presbyterian Hospital March 27, 1902. Patient denies venereal trouble. Has always indulged moderately in alcoholics. Fourteen years ago suffered from an attack of acute intermittent fever. During the past six years patient has had occasional attacks of indigestion.

On January 27 last, patient developed for the first time an attack of severe, cramp-like pain, located in the right hypochondrium, lasting between eight and nine hours, and associated with chilly sensations with subsequent fever. The subsidence of the pain was followed by jaundice, the stools became clay-colored, and the patient was in bed for four days, during which time there was tenderness and swelling over the region of the gall-bladder. The jaundice and clay-colored stools persisted between two and three weeks, and then disappeared, the patient feeling perfectly well and able to resume work.

On February 24 there was a similar attack, the acute, cramp-like pain lasting for seventeen hours, and again on March 25, when the pain persisted for twenty-four hours.

Examination on Admission.—There was tenderness on pressure over the right hypochondriac region and a small mass can be felt, movable with respiration, having the configuration of the gall-bladder. There was considerable rigidity of the upper portion of the right costal arch and of the upper part of the rectus directly beneath it. There was slight icterus, with moderate pulse and temperature elevation. At the end of several days the local symptoms of inflammation, together with the icterus, had subsided, and both pulse and temperature had returned to normal.

Operation (Gas and Ether).—Vertical incision along the outer

border of right rectus about four inches in length, and deepened to and through the peritoneum. The gall-bladder was embedded in a mass of omentum, the upper border of the transverse colon being adherent to the anterior border of the liver. After separation of the adhesions, the gall-bladder was exposed and was found to be slightly increased in size with a very much thickened wall. The neck of the bladder and the cystic duct were then enucleated from the bed of adhesions in

Method of eliciting costal rigidity in upper part of arch, *e. g.*, gall-bladder.

which they were contained, and through their wall numerous calculi could be felt. The gall-bladder was so firmly adherent to the under surface of the liver that its separation could not be accomplished without risk of hemorrhage. It was therefore opened, some forty calculi of varying size removed from its interior, and after the excision of its mucous membrane it was sutured to the parietal peritoneum as in a typical cholecystotomy. Drainage.

Post-operative.—There was moderate temperature and pain. After a week or ten days the bile found its way down the common duct, and the clay-colored stools disappeared. On May 22, the date of discharge, a small superficial sinus persisted, which subsequently closed.

Subsequent History.—Patient continued well for about fourteen months. At the end of that time some soreness and redness developed in the cicatrix, and on examination a small elastic mass could be palpated. Under an anæsthetic the swelling was incised and a small abscess evacuated. Through the abscess cavity the finger could be inserted into the gall-bladder, the walls of which presented a smooth, velvety surface. Only at its fundus, where it emerged into the abscess cavity, was there any evidence of cicatricial tissue. The abscess cavity was drained and quickly closed by granulation without the establishment of a biliary fistula. Since that time (six months ago) there has been no further trouble.

Case II.—R. M.; female; aged forty-four; admitted to the Presbyterian Hospital December 22, 1902. With the exception of occasional attacks of subacute rheumatism, patient has always been well until the development of the present trouble. Last July, after a hard day's work, patient was seized with a severe pain, extending from the pit of the stomach up to the right breast, lasting about one and a half hours and followed by fever and perspiration. During the following night and the next day there were several attacks of slight hematemesis. There was also a slight tinge of jaundice, lasting for several days.

Five weeks ago the second attack occurred, similar in its general features to the first, but more severe. Ever since then these attacks have been repeated on alternate days, without hematemesis, and three weeks ago pain in the right shoulder-blade developed. During this time patient has been unable to attend to her household duties.

Examination on Admission.—There is tenderness on pressure over the region of the gall-bladder, with moderate rigidity of the corresponding portion of the costal arch and of the upper portion of the rectus muscle. No mass can be felt. There is moderate jaundice. Temperature, 100°; pulse, 100; both becoming normal on the day after admission. On the third day after admission, temperature rose suddenly to 105°, the pulse to 100. On the fourth day the temperature

was normal in the morning, but rose to 104° in the afternoon. On the fifth day the temperature rose to 103° and then gradually fell, becoming normal at the end of the week. During this time there was moderate leucocytosis, but repeated examinations of the blood failed to detect the presence of any variety of plasmodium. The local symptoms of tenderness and rigidity had persisted practically unchanged.

Operation January 9 (Gas and Ether).—Vertical incision along the outer border of the right rectus. On opening the peritoneal cavity, the duodenum was found adherent to the under surface of the liver in what corresponded to the fissure of the gall-bladder. The gall-bladder itself was shrivelled up to a small mass of connective tissue containing calculous material. It was separated from the tissue in which it was embedded and removed after ligation of the cystic duct. Closure of the abdominal wound in layers after the insertion of a small cigarette drain to the stump of the divided duct.

Post-operative.—Nausea and vomiting persisted for several days, during which time the pulse varied from 120 to 136 and the temperature between 100° and 102°. At the end of the third day the bowels moved to catharsis, and a biliary fistula became established. Subsequent convalescence, interrupted only by an accumulation of discharge in the wound, three weeks after the operation.

Subsequent History.—Patient has been perfectly well during the past year.

Case III.—C. H. W.; female; aged forty-four; admitted to the Presbyterian Hospital February 8, 1903. Family and personal history negative. Patient has had three attacks of biliary colic, one three years ago, one two years ago, and the last ten days ago. These have all been characterized by dull abdominal pain, most intense in the lower right quadrant, radiating to the epigastrium and up the back, lasting from four to six hours and necessitating the patient's going to bed. There has been occasional vomiting during the attacks and considerable constipation. There has never been any jaundice. Three days ago the fourth and most severe attack developed, the character and the location of the pain being the same as in the previous attacks.

Examination on Admission.—There is rigidity of the upper portion of the right costal arch and of the adjacent rectus muscle. A smooth, elastic mass of oval shape may be felt occupying the region of the

gall-bladder, extending down from the lower border of the liver to a point one inch below the umbilicus. It is tense and elastic, and by bimanual examination fluctuation may be detected. It is dull on percussion.

The patient was treated by local applications of ice and kept in bed. At the end of ten days the pain had disappeared, the mass had greatly diminished in size, reaching inferiorly to a point two inches above the level of the umbilicus. Some costal rigidity still persisted. During this interval the temperature reached a point no higher than 100° and the pulse at no time exceeded 90.

Operation, February 20 (Gas and Ether).—Vertical incision along the outer border of the right rectus. On opening the peritoneum, the omentum was found adherent to the gall-bladder, which was greatly thickened, somewhat distended, and contained a considerable amount of thick fluid, detritus, and hardened concretions. After the separation of the omentum and the examination of the cystic and common ducts, which were found to contain no calculi, the gall-bladder was opened and a *cholecystostomy* performed, the mucous membrane having been removed with scissors and forceps. A probe could be passed through the gall-bladder into the duodenum.

The convalescence was uninterrupted, the resulting biliary fistula closing in about six weeks. There has been no recurrence.

Case IV.—M. W.; female; aged forty-two; admitted to the Presbyterian Hospital April 6, 1903. Family and personal history negative. Fourteen years ago patient was seized with abdominal pain, cramp-like in character, located in the epigastric region on either side of the median line, but more severe on the left side, lasting for several days. Since that time these attacks, preceded by a chill and frequently accompanied by nausea and vomiting, have recurred at intervals of every month or two, until the last six months, when the attacks have occurred as frequently as every week or ten days. Each attack lasts generally about one or two hours, occasionally for as long a time as two days. Seven years ago, during an attack, jaundice developed and has recurred frequently during the past six months. The attacks have also been characterized by pain in the back.

Examination on Admission.—There is tenderness in the region of the gall-bladder, but no mass can be felt. There is rigidity of the

corresponding portion of the costal arch and of the adjacent rectus muscle. On the day of admission the temperature rose to 106°, preceded by a chill, the pulse to 120. On the following day both the pulse and temperature were normal.

Operation (Gas and Ether).—Vertical incision along the outer border of the right rectus. On opening the abdominal cavity, the gall-bladder was completely buried in a mass of adhesions of omentum and duodenum. These were readily separated, however, and the bladder was dissected from the under surface of the liver to a point corresponding to the junction of the cystic and hepatic ducts without any considerable hemorrhage. The common duct was found to be free, a probe being passed down into the duodenum. The pancreas was thickened, and the foramen of Winslow was obliterated. The cystic duct was ligated with chromic gut and the abdominal wound closed after a cigarette drain had been inserted down to the stump of the divided duct.

Post-operative.—The patient suffered but little pain. After the end of a week the drain was removed. At no time was there leakage of bile. At no time was either the pulse or temperature above 100.

Examination of the gall-bladder showed its wall to be very much thickened and its cavity to contain several hundred calculi about the size of dice. Its wall was considerably inflamed.

Patient has enjoyed excellent health since the operation.

Case V.—M. C.; female; aged sixty-six; admitted to the hospital March 16, 1902. Two years ago patient suffered from colicky pain in the region of the gall-bladder, radiating to the opposite side and regularly followed by chills, fever, constipation, and jaundice. These attacks recurred at intervals of four months, and recently as frequently as two or three times a week. The duration of the attack has varied between one and two days. Patient has lost twenty pounds in weight and has become very weak.

Examination on Admission.—Patient is moderately jaundiced. On palpation, there is increased costal rigidity in the region of the gall-bladder and of the adjacent rectus muscle. By bimanual examination the smooth oval outline of the gall-bladder may be felt projecting a distance of two inches below the lower level of the liver. It moves with respiration. Examination of the urine shows it to be of a specific gravity of 10.20, and to contain a small amount of albumin and hyaline

casts. The patient's discomfort was so great and the progressive loss of flesh and strength so marked, that she desired to take the risk of an operation notwithstanding the unfavorable condition of the urine.

Operation (Gas and Ether).—The gall-bladder was exposed through a vertical incision along the outer border of the right rectus, and was found to be moderately distended and free from adhesions. Owing to her general condition, a cholecystectomy was considered ill-advised, and therefore after noting the absence of any calculi in either the cystic or common ducts, the gall-bladder was incised, its contents evacuated, and a cholecystotomy performed. The gall-bladder contained a considerable amount of thick mucus and several friable calculi of large size.

Post-operative.—The patient did nicely for forty-eight hours, the pulse remaining under 100, and without special rise in the temperature. At the end of that time the urine decreased rapidly in quantity, the albumin and casts increased, and the symptoms of acute uræmia became established, the patient dying one week after the operation. Unfortunately no autopsy could be obtained. There was no symptom of peritonitis.

Case VI.—L. J.; male; aged twenty-five; admitted to the Presbyterian Hospital November, 1903. Patient was always well until about two years ago. At that time, and again six months later, patient suffered from two attacks of catarrhal appendicitis, of which the latter was the more severe. Shortly after the subsidence of the last-mentioned attack the appendix was removed, the wound healing by primary union.

The patient continued to enjoy excellent health until one year ago, when, without warning, a severe colicky paroxysmal pain developed in the right hypochondrium radiating from there to the epigastric region and back. Icterus developed, the stools became clay-colored, and the patient was confined to bed for three weeks, chiefly on account of the severity of the paroxysmal pain. The attack then subsided and the patient was well until five weeks ago, when the pain recurred. On this occasion it was continuous, and rapidly became so severe as to require hypodermics of large amounts of morphine. This attack has been associated with moderate jaundice. There has been scarcely any rise of temperature at any time during the attack.

Examination on Admission.—There was acute tenderness on pressure in the region of the gall-bladder, with rigidity of the upper segment of the rectus. The adjacent portion of the costal arch was very rigid and cannot be depressed any appreciable distance toward the vertebral column. On bimanual examination a small rounded mass about the size of a lemon could be felt projecting downward below the free border of the liver at a point opposite the junction of the eighth and ninth costal cartilages. For the twenty-four hours preceding operation the temperature varied between 99° and 100°; the pulse remained between 70 and 80. There were 15,000 and 20,000 leucocytes respectively in two examinations, separated by an interval of twenty-four hours.

Operation (Gas and Ether).—A vertical incision along the outer margin of the right rectus, to the upper extremity of which was later added a horizontal incision extending inward through the fibres of the rectus. The gall-bladder was completely hidden from sight by the adherent great omentum and colon, but was rather easily enucleated down to the region of the foramen of Winslow. The gall-bladder was of large size, its walls thickened and greatly distended, and its separation from the liver above was accomplished only with considerable difficulty. No calculi could be felt in any part of the common duct, and the organ was removed by the division of the cystic duct between clamps, the divided duct and its accompanying vessels being subsequently ligated with chromic gut. After the insertion of a rubber drain down to the stump, and a cigarette drain to the same place through a counter-opening in the right flank, the abdominal wound was closed.

Examination of the gall-bladder showed its wall to be very considerably thickened, especially in the vicinity of the junction of its neck and the cystic duct, where almost complete obliteration has resulted from the previous productive inflammation. Its cavity contained a considerable quantity of thick turbid fluid with a small quantity of bile only. There were two large faceted calculi of the size of acorns and of a peculiar nutmeg appearance.

Post-operative.—During the first twenty-four hours there was a gradual increase in the pulse and temperature from 88 and 101° to 128 and 104° respectively in the afternoon. There was considerable pain and some nausea and vomiting. There was a free discharge of

bile from the upper wound on the second day, and forty-eight hours after the operation the pulse had diminished to 94 and the temperature had receded to 103°. On the third day the bowels moved to catharsis, the stools being clay-colored. From this time there was a gradual subsidence in the temperature, and the pulse varied between 72 and 80. Some distressing hiccough, however, continued until the beginning of the second week. At about the end of the second week the biliary discharge decreased and the stools began to lose their clay color. At the end of the third week the amount of biliary discharge was very slight. At no time was there any discharge of bile through the counter-opening in the flank, which promptly closed after the removal of the drain.

Five weeks after the operation patient returned to work with a very small biliary fistula, which has since closed.

Case VII. Acute Cholecystitis without Calculus.—F. K.; male; aged thirty-seven; admitted to the Presbyterian Hospital January 31, 1902. Patient, a painter by occupation, admits a moderate beer habit until ten years ago, since which date he has drunk but very little.

For the past fourteen years, at some time during the summer, patient has had an attack of diarrhœa with slight jaundice, lasting for two or three days. The last attack, one year ago, was more severe than any of the others. The present attack began one week ago, with a chill, followed by a rise of temperature to 105°. There was vomiting and pain over the vicinity of the gall-bladder. The bowels were constipated and of a lighter color than normal. The urine was high-colored.

Examination on Admission.—The whole abdomen was slightly retracted. There was pain and tenderness over the gall-bladder, but no enlargement can be detected. There was rigidity of the corresponding part of the costal arch and of the adjacent rectus. There was also moderate rigidity of the lower right quadrant and of the entire left half of the abdominal wall. Temperature was 103°, the pulse 100 (at no time higher), both rapidly decreasing and reaching normal within several days, with simultaneous subsidence of the local symptoms.

Operation One Week after Admission (Gas and Ether).—A vertical incision over the outer upper border of the right rectus deepened into the peritoneal cavity. The gall-bladder was distended, its wall was thickened, and it contained turbid bile. Its lining membrane was

congested. There were no calculi. A probe could not be passed into the duodenum. The operation was completed by suturing the gall-bladder to the parietal peritoneum and inserting a drain of gauze into its cavity.

Post-operative.—The convalescence was uneventful, the biliary fistula closing within two months.

December 1, 1902. Patient has enjoyed excellent health since the operation.

Case VIII. Cholelithiasis in the Quiescent Stage.—N. P.; female; aged thirty-one; admitted to the Presbyterian Hospital May 31, 1902. Patient was always well until five weeks ago, when, without known cause, she was seized with an attack of vomiting and of general abdominal pain, becoming localized within twenty-four hours over the region of the gall-bladder. Subsequently the pain extended to the right scapular region. There was slight jaundice and fever. The stools were of a greenish color and constipated. The pain was so severe as to require chloroform inhalations. In forty-eight hours the attack had subsided. One week later a similar attack occurred, lasting for thirty-six hours, and followed by pain in the right scapular region for days afterward.

Examination on Admission.—There was pain and tenderness over the region of the gall-bladder, the pain being also elicited by indirect pressure through the overlying eighth costal cartilage. There was rigidity of the corresponding portion of the costal arch, but none of the adjacent rectus muscle. In other respects abdominal examination was negative.

Operation (Gas and Ether).—A vertical incision was made along the outer border of the right rectus. On opening the peritoneum, the gall-bladder presented free from adhesions, of small size, firmly fixed to the under surface of the liver, and through its walls several calculi could be felt. The foramen of Winslow was obliterated, but no calculus could be felt in either the cystic or common duct. The gall-bladder was cautiously opened and six calculi, each faceted and about the size of an acorn, were removed. The mucous membrane was excised, and the bladder stitched to the parietal peritoneum. No probe could be passed into the duodenum.

Post-operative.—Patient had several attacks of sharp abdominal pain, resembling biliary colic, during the first six hours after the operation. These attacks ceased with the generous discharge of yellow-colored bile

through the fistula, and the further convalescence was undisturbed and uneventful, the biliary fistula closing completely within six weeks.

December 15, 1903. Patient has enjoyed excellent health since the operation.

Case IX. Cholelithiasis in the Quiescent Stage.—M. K.; female; aged forty-six; admitted to the hospital December 11, 1901. Patient has always enjoyed excellent health until five months ago, when she suffered from an attack of dysentery lasting five to six weeks. Three months ago patient was seized with a severe attack of vomiting and of abdominal pain over the region of the gall-bladder, lasting for several days. There was slight jaundice and costive, slightly clay-colored stools. Since then the attacks have recurred every few days, their onset being favored by the ingestion of any form of solid food. During each attack she is prostrated and unable to attend to her household duties. The constipation is constant.

Examination on Admission.—Patient was very corpulent, with a large, pendulous abdomen. There is slight icterus. There was tenderness over the region of the gall-bladder. There was rigidity of the corresponding portion of the costal arch of moderate degree, but no rigidity of the adjacent segment of the rectus muscle.

Operation (Gas and Ether).—An oblique incision, parallel to the lower border of the costal arch, was made, with its centre over the region of the gall-bladder. This organ was found completely embedded in adhesions and of small size. It had been drawn nearly to the median line by the contraction of the tissue in which it was embedded, and was adherent to both the stomach and the under surface of the liver. The gastro-hepatic omentum was very considerably shortened, the lesser curvature of the stomach lying close to the under surface of the liver, and the foramen of Winslow obliterated. The gall-bladder was very atrophic, and its wall a thickened mass of connective tissue. It was opened and several small calculi and considerable calculus detritus were removed. Owing to the density of the adhesions, it could not be separated from the adjacent liver without undue risk of hemorrhage. A tampon of gauze was then inserted down to the orifice and into the cavity of the atrophic bladder, it being impossible to approximate it to the parietal peritoneum. Closure of the incision in layers on either side of the drain.

Post-operative.—The patient suffered intense pain for forty-eight hours, at the end of which time the biliary fistula became established. The vomiting was also persistent for three days, until the bowels moved. There was no distention. After the third day rapid improvement, the further convalescence being uneventful and the fistula completely closing in six weeks.

December, 1903. Except for slight rheumatic pains, patient has had excellent health since the operation.

Case X. "*Perihepatitis.*"—E. B.; male; aged fifty-five; admitted to the Presbyterian Hospital December 6, 1902. Patient has always been well. No history of venereal difficulty. No alcoholic habit.

Three days before admission to the hospital, after exposure to cold, patient suffered from a chill, with pain in the lower right side of the chest, both in front and behind, the right hypochondrium being sensitive to pressure. There was fever, also cough, which was dry, prostration, and the patient was confined to bed. The pain persisted and was cutting in character; it was intensified by deep inspiration. The bowels were constipated and the urine was high-colored.

Examination on Admission.—The conjunctivæ are icteric. The entire abdomen is rigid, the rigidity being most marked in the right upper quadrant over the region of the gall-bladder. There is a very distinct resistance of the upper half of the right costal arch. The temperature varied between 101° and 104°, the pulse from 88 to 104. The leucocytosis in several examinations varied between 16,000 and 20,000.

Operation (Chloroform).—A vertical incision was made parallel to the outer margin of the right rectus. The lower part of the peritoneal cavity was free from adhesions, but there was a distinct increased intra-abdominal tension characterized by the tendency of the intestines to prolapse through the abdominal incision. The gall-bladder and ducts were normal. Exploration of the liver with a hypodermic needle gave a negative result. The entire upper surface of the right lobe of the liver was joined to the diaphragmatic and parietal peritoneum by numerous adhesions of varying density which were separated from their point of attachment on the liver only with considerable difficulty. In other respects the liver appeared normal. The adhesions were broken up, and the abdominal wound closed in layers, a cigarette drain being left in the lower angle.

Post-operative.—On the morning after the operation the patient declared that he was free from pain and that he felt very much better. The improvement steadily continued, and at the end of a week both the pulse and temperature had returned to normal. The wound healed *per primam*, and at the end of four weeks the patient returned to work feeling perfectly well.

December, 1903. Patient has enjoyed excellent uninterrupted health since the operation.

Case XI. Sarcoma of the Liver.—K. H.; female; aged forty-nine; admitted to the Presbyterian Hospital March 2, 1903. Previous history negative. About eighteen months ago patient suffered from occasional sharp pains in the right iliac and lumbar regions. These occurred in attacks about once a month and were accompanied with vomiting. A physician, called in attendance at that time, diagnosed "abdominal tumor." These symptoms continued until five weeks ago, when the pain became more severe and was brought on by the slightest exertion. For the greater part of that time the patient has remained in bed. The bowels have been habitually constipated. There has been no jaundice. There has been considerable loss of flesh and strength.

Examination on Admission.—There was asymmetrical bulging of the abdominal wall, the right side being protruded by some underlying growth which extends a distance of three inches to the left of the median line. Above, it disappears beneath the costal arch, and below, in the median line, it extends to within two inches of the symphysis. There was asymmetrical respiratory movement of the costal arches, the right remaining almost motionless during expiration. On palpation, the bulging was found to be due to the presence of an abdominal growth moderately elastic, yet of firm consistence, with a smooth surface. Above, it was lost beneath the right costal arch, which cannot be depressed toward the vertebral column, and below, by rectal examination, the mass can be felt to occupy the upper part of the pelvis. Percussion over the tumor yields a flat note, continuous above with the liver flatness. The mass can be moved slightly from side to side without much discomfort to the patient.

Operation (Gas and Ether).—Incision parallel to the outer border of the right rectus, extending upward above the level of the umbilicus.

On opening the peritoneal cavity, the mass was found to be adherent to, and to infiltrate extensively, the anterior abdominal wall. The abdominal wound was closed after a portion of the tumor had been removed for subsequent microscopical examination.

Post-operative.—The patient recovered from the effects of the operation, but her general condition gradually became weaker, and death occurred in about two weeks.

Microscopical examination of the tumor, which was evidently primary in the liver, showed it to be a spindle-cell sarcoma.

Case XII.—L. L.; male; aged thirty-five; admitted to the Presbyterian Hospital April 14, 1902. Moderate alcoholic habit. There is no history of colitis. About nine months ago patient suffered from an attack of catarrhal appendicitis, from which he recovered without operation. With this exception until ten days ago he had been well and able to work.

At that time he was suddenly seized with severe pain in the epigastrium, equally pronounced on both sides. It was accompanied by chill, followed by fever and sweating. There was no vomiting. These symptoms have continued except for short intervals, the pain being so severe as to interfere with sleep. During the past week the pain has become localized in the right hypochondrium and epigastric regions, and tenderness has developed. The bowels have been constipated, no movement having taken place for the last three days. The stools have been of normal color. There has been no jaundice. During this time the prostration has been sufficient to confine the patient to bed.

Examination on Admission.—There is diminished respiratory movement of the upper part of the abdomen and of the costal arch. On palpation, in the middle line, extending from the ensiform appendix to within one inch of the umbilicus, is a mass of which the surface is smooth, the consistence elastic. It is tender under pressure, and extends farther to the right than to the left of the median line. The pain is increased by deep respiration and also by efforts to turn the body from right to left. The mass moves up and down with the respiratory movement of the liver. There is rigidity of the upper portions of both costal arches, more marked, however, on the right than the left side. There is some rigidity of the adjacent portions of the recti muscles.

The temperature is 102°, varying between 101° and 103°. The pulse remains under 100. There are 15,000 leucocytes.

Operation (Gas and Ether).—Incision in the median line above the umbilicus. The wall of the abscess cavity was found adherent to the parietal peritoneum, and the cavity was opened, evacuating about one pint of pus, without entering the general peritoneal cavity. The size of the abscess cavity was about that of an orange, and the pus was thick and of a red color. Partial suture, with a rubber drain enveloped in gauze.

Post-operative.—There was immediate relief from the pain, with prompt return of both pulse and temperature to normal. The abscess cavity gradually closed by granulation without the leakage of bile. Four weeks after the operation, a sinus, about one and one-half inches deep, remained, subsequently closing.

December 1, 1902. Patient had enjoyed excellent health since leaving the hospital. A slight rupture has developed in the lower part of the cicatrix.

Case XIII.—R. D.; male; aged twelve; admitted to the Presbyterian Hospital November 2, 1902. With the exception of chronic ear difficulty following one of the exanthemata, patient has always enjoyed excellent health. On October 17 last, patient was operated on at the Manhattan Eye and Ear Hospital of this city for mastoiditis with thrombosis of the lateral sinus. The mastoid cells were thoroughly opened and the internal jugular vein ligated about the centre of the neck. The patient made an excellent recovery from the effects of the operation, both pulse and temperature becoming normal at the end of the tenth day, and both the wounds presenting a healthy granulating appearance. Two days ago, without known cause, patient developed very sharp pain in the right hypochondrium. This pain was manifested in attacks of several minutes' duration, at intervals of from half an hour to one hour, and was accompanied by a rise in temperature to 102°, and of the pulse to 130. There was no chill. During the next twenty-four hours the pulse rose to 180, the temperature to 104°, and the patient was transferred to the Presbyterian Hospital for possible operation.

Examination on Admission.—On inspection, there was a marked bulging of the right hypochondrium, extending as low as the level of the umbilicus. The corresponding portion of the costal arch was dis-

placed forward and shows diminished respiratory movement. On palpation, the mass was smooth, elastic, and very tender, moving up and down with respiration. There was very pronounced rigidity of the overlying costal arch and of the adjacent muscle. There was slight rigidity of the left costal arch. Patient lay on the right side with the thighs flexed, any change from this position intensifying the pain. There were 23,000 leucocytes.

Operation (Chloroform).—A vertical incision was made along the outer border of the right rectus, extending from the costal arch downward. On opening the peritoneal cavity, a small amount of serous fluid escaped, and the enlarged right lobe of the liver bulged prominently into the wound. A needle inserted into the most prominent part of the right lobe at a depth of about two inches, withdrew turbid opaque fluid of a gray color and entirely free from odor. The track of the needle was enlarged with the cautery and several ounces of this fluid evacuated. The cavity was drained with both gauze and tube.

There was considerable restlessness for twenty-four hours. Both pulse and temperature fell slowly for six days to 101° and 100° respectively. There was then, without known cause, a shoot of temperature to 104°, and of the pulse to 120, without wound-disturbance discoverable. Both gradually subsided, reaching normal at about the end of a month. There was no vomiting at any time, the patient taking considerable quantities of fluid nourishment.

The discharge from the wound was yellow and abundant for the first ten days, gradually diminishing as the cavity closed. At the end of a month a superficial sinus only remained. At this time no enlargement of the right lobe could be detected by bimanual examination. Seven weeks after the operation patient left the hospital entirely healed, and remained in excellent health until the following April 21, when he was readmitted suffering from bronchitis and a pleurisy over the lower part of the right lung. Both of these conditions disappeared in the course of ten days, and since that time there has been no further trouble.

Through a misunderstanding, the fluid removed was not subjected to a rigid examination. Cursory examination showed it to contain a considerable number of leucocytes, and to be relatively free from any of the bile constituents.

Case XIV.—A. M.; male; aged thirty-one; admitted to the Gouver-

neur Hospital May 29, 1902. Previous history negative. Several days before admission patient developed the symptoms of fever, which did not subside, and he was brought to the hospital. On admission he was found to be probably suffering from typhoid fever, the diagnosis being subsequently rendered certain by the presence of the Widal reaction. For the first three weeks the course of the fever presented nothing materially different from the typical case. During the fourth week there was an increase in the temperature and in the rapidity of the pulse; at the same time the patient complained of pain in the right hypochondrium over the region of the liver. Examination showed rigidity of the upper part of the costal arch with tenderness on pressure. No enlargement of the liver could be detected. There was a leucocytosis of 15,000. Exploration was advised, but refused until July 2. During this time the pain and tenderness increased and the curve of the temperature was that ordinarily seen in collections of pus. The rigidity of the arch had also extended to its lower portion.

Operation (Gas and Ether).—Through a vertical incision parallel to the outer border of the right rectus above the umbilicus the peritoneal cavity was opened and the upper surface of the liver exposed. At a depth of two inches in the right lobe an abscess cavity was detected and pus withdrawn with a hypodermic needle. The pus was evacuated, the liver tissue being divided with a cautery, along the needle as a guide. Drainage with tube and gauze.

Post-operative.—The patient reacted well from the operation and was considerably relieved, there being marked improvement in both the local and constitutional symptoms. The upper portion of the arch resumed its normal resiliency, but the lower portion still remained rigid. Before the expiration of a week the temperature and pulse again became higher, and pain and tenderness developed over the region of the liver behind, the resistance of that portion of the arch becoming more marked. There was also an increase in the pre-existing leucocytosis.

Operation July 16 (Gas and Ether).—An oblique incision was made parallel to the twelfth rib posteriorly, the rib excised subperiosteally, and the lowest angle of the pleural cavity opened. There were no adhesions. The opposite diaphragmatic pleura bulged into the wound,

and, after the withdrawal of pus with a needle, the diaphragm was incised, opening a large subdiaphragmatic abscess extending into the posterior portion of the right lobe of the liver. This was drained with gauze and tube, the pleural cavity being shut off by sutures between the parietal and diaphragmatic surfaces.

The patient reacted well from the operation and the drainage was very satisfactory. There was marked subsidence of the local pain and tenderness. The temperature, though somewhat lower, still ran a pyæmic course, and the patient gradually became weaker, dying from exhaustion five weeks later.

Case XV.—E. F.; male; aged forty-eight; admitted to the Presbyterian Hospital February 25, 1901. Patient is an Italian, and a satisfactory past history is difficult to obtain. Five weeks ago he was treated in one of the city hospitals with the history of pain in the back and the right hypochondrium for an indefinite length of time. There were no constitutional symptoms of fever. On exploratory operation, the liver was found to extend two inches below the level of the costal margin. Aspiration of the right lobe withdrew no fluid. The abdominal wound healed *per primam*, but the patient developed an irregular temperature and some jaundice, with progressive loss of flesh and strength. The pain in the right hypochondrium still persisted.

Examination on Admission.—The patient is poorly nourished and cachectic. There is slight icterus. There is a well-marked projection of the right hypochondrium, the respiratory movement of the costal arch being diminished. There is dilatation of the surface veins. On palpation there is a smooth mass, deeply seated, projecting inferiorly below the level of the costal margin, a distance of two inches, of which the lower border is indistinct. There is well-marked rigidity of the corresponding portion of the costal arch and of the adjacent rectus muscle, with some tenderness on pressure over the centre of the tumefaction. Patient's temperature ranged from 101° to 102°, the pulse around 100. There was moderate leucocytosis.

Operation (Gas and Ether).—A vertical incision was made along the upper outer border of the right rectus in the line of the cicatrix. On opening the peritoneal cavity there were no adhesions. The right lobe of the liver was enlarged and projected several inches below the costal margin. A needle inserted into its most prominent portion

withdrew pus at the depth of about one and one-half inches. The pus was thick and of a creamy-yellow color. The needle was left *in situ*, iodoform gauze being packed around its point of emergence from the liver, thus shutting off the peritoneal cavity, and at the end of four days the abscess cavity was thoroughly opened along the line of the needle with the Paquelin cautery. The cavity was about the size of a cocoanut, and contained over a quart of pus.

Post-operative.—There was gradual subsidence of both pulse and temperature, reaching normal on the sixteenth day. There was immediate cessation of the pain. For the first few days the discharge from the abscess cavity was very profuse, and contained a considerable amount of bile. It then gradually diminished, and at the end of two weeks was very slight. On the sixteenth day after the operation pain developed in the left hypochondrium, and the biliary fistula manifested a marked increase in activity. There was a rise in both pulse and temperature. The leucocytosis was again increased to from between 12,000 and 16,000. On examination, there was rigidity of the left costal arch near the junction of the eighth and ninth costal cartilages and of the adjacent rectus muscle, with tenderness on pressure. After four days the patient finally consented to an exploratory incision.

Second Operation (Gas and Ether).—A vertical incision was made along the outer upper border of the left rectus. The peritoneal cavity showed no evidence of adhesion. The left lobe of the liver was normal in appearance. A needle inserted, however, withdrew a small amount of pus at a depth of two inches. The opening was immediately enlarged with the cautery and several small abscess cavities enlarged into one with the finger. Rubber tube and gauze drainage.

Post-operative.—The patient made an excellent recovery, both local and constitutional symptoms disappearing promptly. The discharge from the biliary fistula on the right side rapidly decreased, and on leaving the hospital the patient had gained weight and was in very much better condition than at the time of his admission.

June, 1902. Patient has gained forty pounds during the past year and has enjoyed excellent health.

No culture could be found in the pus.

Case XVI. Subdiaphragmatic Abscess Complicating Acute Appendicitis.—M. H.; female; aged eight; admitted to the Presbyterian Hos-

pital June 20, 1901. Previous history negative. Five days ago patient was seized with sudden severe pain in the right lower quadrant of the abdomen. At the end of two days, during which time the pain recurred at intervals, patient developed vomiting, diarrhœa, and prostration, with excessive abdominal tenderness. The vomiting and diarrhœa ceased at the end of twenty-four hours, but the weakness and prostration persisted and became more pronounced.

Examination on Admission.—The entire abdomen was swollen, especially on the right side. There was no expiratory recoil of the right costal arch. Moderate recoil of the left arch. The right half of the abdomen is excessively tender and rigid. The right costal arch is protruded slightly forward and cannot be depressed even for a short distance toward the vertebral column. There was some rigidity of the left abdominal wall, especially in the lower half, but it was less marked than on the right side. The temperature was 104°, the pulse 140 and weak, the respiration 46. The leucocytes taken twelve hours after operation amounted to 17,000.

Operation (Gas and Ether).—Incision along the outer border of the right rectus muscle, extending from the region of the appendix to the costal arch above. The opening of the peritoneal cavity was followed by the evacuation of a large amount of pus, which distended a cavity reaching from the brim of the pelvis below to the lower surface of the diaphragm above, extending both in front of and behind the liver. That portion of the pus situated in front of the liver escaped only after the costal arch was elevated by the surgeon's hand. The appendix was gangrenous and was removed by ligation and cauterization of the stump. The abscess cavity was carefully cleansed with peroxide of hydrogen and was drained both above and below with tubes and strips of gauze, a counter-opening being made posteriorly along the lateral margin of the colon, and a gauze tampon being introduced between the upper surface of the liver and the anterior abdominal wall. The middle part of the wound was held together with one suture.

Post-operative.—On the day following the operation temperature rose to 106°, the pulse varied between 150 and 160, and there was considerable restlessness and delirium. There was no vomiting nor tendency to an increase in the distention, and the patient retained a considerable amount of fluid nourishment. There was moderate peri-

stalsis over the left side of the abdomen. On the second day flatus escaped from the rectum, the bowels moved, and there was progressive diminution of both pulse and temperature, reaching 120 and 103° respectively on the third day. From this time on there was gradual improvement, continuing for two weeks and a half, the temperature ranging between 101° and 102°, the pulse around 120, and the wound draining very freely both in front and behind. At the end of this time the constitutional symptoms of sepsis increased in severity, and there seemed to be slight retention of pus in the upper portion of the wound. Three days afterward expectoration of pus occurred, followed by symptoms of collapse and the death of the patient. No autopsy was allowed, but the extension of the suppurative process along the lymphatics in the diaphragm had evidently not been successfully checked by the operation and had caused the fatal issue.

Case XVII. Acute Pancreatitis.—E. P.; male; aged twenty-eight; admitted to the Presbyterian Hospital June 13, 1901. Previous history negative. Three days before admission the patient experienced some abdominal pain, with one attack of vomiting and general malaise. The bowels were constipated and failed to move since. There was no chill. The prostration steadily increased, and the abdomen has become more tender and moderately distended. He has taken no nourishment. His chief complaints are pain and prostration.

Examination on Admission.—Patient was a well-nourished and muscular man. The entire abdomen was markedly distended. The abdominal pain was general and not referred to any one point. On palpation, there is general abdominal rigidity, most marked in the right upper quadrant. There was increased resistance in the upper part of the right costal arch. There was slight dulness in both flanks, especially the right. On auscultation, peristaltic sounds were heard over the entire abdomen. The urine had a specific gravity of 10.44, was of acid reaction, contains twelve per cent. (by volume) of albumin, and on microscopical examination numerous hyaline and granular casts are found. On admission, temperature was 103°, the pulse 124 and very weak, and the respiration 28. There was a leucocytosis of 27,000.

Operation (Gas and Ether).—An incision four inches long was made along the outer border of the right rectus above the umbilicus. The peritoneal cavity contained considerable quantities of dark-brown fluid

not encapsulated and most abundant in the right upper quadrant. As it was sponged away, it seemed to be renewed by similar fluid emerging from the foramen of Winslow. The small intestine was moderately distended. The gall-bladder, the gall-ducts, and the appendix were normal. The head of the pancreas was swollen and of peculiar "boggy" consistence. After the careful cleansing of the upper right peritoneal cavity a Mikulicz drain was inserted down to the region of the foramen of Winslow, and the lower part of the wound closed by interrupted suture. Although the operation was quickly performed, the patient's pulse became so feeble as to require a saline infusion.

Post-operative.—On the day after the operation the pulse rose from 132 to 150 and could scarcely be felt at the wrist. The temperature varied between 103° and 104°. The patient was restless and perspired profusely. There was no vomiting, and the patient retained considerable quantities of fluid nourishment. Owing to the weak condition of the pulse, hypodermoclysis was given.

On the second day after operation the pulse varied between 130 and 140 and was slightly stronger. The temperature varied between 102° and 103°. The extremities, which had been cold, became warmer. Several hours after the administration of a laxative there were several dejections consisting of solid and semi-solid brownish material. The patient declares that he feels perfectly comfortable.

From this time on there was steady and gradual improvement, the temperature reaching normal on the sixteenth day. Four weeks after the operation the patient left the hospital with a small sinus.

The subsequent history of the patient is unknown, repeated endeavors to communicate with him having failed.

Case XVIII. Large Pancreatic Cyst.—A. B. M.; male; aged thirty-nine; admitted to the Presbyterian Hospital October 6, 1902. Patient's sister had an ovarian cyst. Patient was a hard drinker of whiskey until several years ago, since which time he has touched no liquor whatever. Has always used tobacco in moderation.

Seven years ago patient was seized with an attack of sharp pain, knife-like in character, referred to the left hypochondrium and intensified by inspiration. It was accompanied by vomiting and prostration, the former ceasing after several days, the latter being so severe as to confine the patient to bed for five weeks, during which time the attending

physician noticed a swelling in the left side, which was so small as not to be appreciated by the patient. These attacks were repeated, recurring at first every month, subsequently at increasing intervals, until two years ago, at which time they ceased entirely. No attack lasted for more than forty-eight hours, nor did any attack confine the patient to bed.

The tumor has steadily increased in size, especially at the time of an attack, and for the past six years has been noticeable to the patient. There has been progressive loss of flesh and strength, the patient weighing thirty pounds less than he weighed seven years ago, and the weakness having become more pronounced during the past two years, and there has been some shortness of breath. At present the swelling has reached so large a size as to be inconvenient, and this, together with the general weakness and shortness of breath, constitute the chief complaints.

Examination on Admission.—The abdominal cavity was the site of an asymmetrical swelling involving the entire left side and extending for a distance of three inches, in its most prominent portion, to the right of the median line. The greatest convexity of the overlying abdominal wall was seen in the left upper quadrant, and the corresponding portion of the costal arch was pushed prominently forward and had no expiratory recoil. There is also extensive bulging of the left flank and ileo-costal space.

On palpation, the tumor was smooth, of elastic consistence, and by bimanual examination a fluid wave could readily be detected passing from its upper right to its lower posterior portion in the ileo-costal space. There is no fremitus. The portion of the tumor overlying the abdominal aorta presents expansive pulsation. There was rigidity of the entire upper left costal arch, and any effort to depress it toward the vertebral column encounters distinct elastic resistance. There was slight descent of the mass during inspiration.

On percussion, the entire tumor was flat, being continuous above with the area of cardiac dulness and obscuring the normal area of splenic dulness. The intestinal resonance was situated chiefly in the lower right quadrant of the abdomen. By inflation, the stomach and descending colon are found to lie anterior to the cyst.

Repeated examination of the stools gave no evidence of the presence of undigested fat, and there was no glycosuria or other abnormal condition of the urine.

The general condition of the patient was fair, the heart action of good force and regular.

Operation October 15 (Gas and Ether).—Vertical incision two and one-half inches from the median line, extending an equal distance above and below the level of the umbilicus, and situated over the most prominent part of the tumor. On opening the peritoneal cavity, the smooth, pearly cyst-wall presented, with the splenic flexure lying on its anterior surface. This was reflected with some difficulty a short distance toward the median line in order to bring the contemplated opening through the cyst-wall directly opposite the abdominal incision. The entire cyst was retro-peritoneal, and so firmly adherent to the stomach, the colon, the spleen, and the posterior abdominal wall, as to render any enucleation impossible. The cyst was therefore emptied of its contents, consisting of several gallons of yellow turbid fluid, with a trocar and cannula, and its interior explored through an incision in its anterior wall. In this manner the left kidney could be distinctly palpated behind it, and the pancreas, also posterior, could be felt a little higher up and near the median line. A counter-opening was made to the outer side of the kidney in the left ileo-costal space, a portion of the cyst-wall being here excised without difficulty. The edge of the anterior opening in the cyst-wall was sutured to the corresponding edge of the divided parietal peritoneum, and after the insertion of drainage-tubes both in front and behind, into the cyst cavity, the upper and lower extremities of the abdominal incision were closed by suture.

Post-operative.—There was some vomiting and hiccough for several days, and the bowels moved with rather more difficulty than usual, responding to catharsis on the third day, followed by subsidence of the above symptoms. At no time was the pulse higher than 80, and there was but slight temperature elevation. The discharge from the anterior of the cyst was very slight. During the next ten days the bowels moved regularly, and patient was very comfortable, complaining only of occasional abdominal cramp-like pain.

October 27. Patient vomited several times this afternoon. Bowels moved freely with enema. There was no rise in the pulse or temperature.

October 28. Patient vomited again to-day. Some cramp-like abdominal pain developed. Bowels again moved after an enema. There was no abdominal tenderness. Pulse and temperature still con-

tinued normal. Some local distention developed in the right iliac fossa, evidently due to an inflated cæcum.

October 29. Distention increased, and the pulse rose to 100, the temperature to 101°. An exploratory incision was deemed advisable. Under ether, an incision was made over the outer border of the right rectus, below the umbilicus, and the peritoneal cavity was found to contain a considerable amount of fluid fæcal material. The perforation could not be found nor could its cause be ascertained. Drainage. Patient rapidly became worse and died the following morning.

Autopsy.—The site of the perforation could not satisfactorily be located. The cyst was found to spring from the tail of the pancreas.

Case XIX.—M. K.; female; aged twenty-four; admitted to the Presbyterian Hospital August 27, 1900. Eleven years ago patient was thrown from a wagon, but was not incapacitated. Between two and three years later kyphosis developed in the dorso-lumbar region, requiring the application of an orthopedic corset.

Nine months ago, without known cause, painful and frequent urination suddenly developed. There were burning sensations over the bladder, intensified by micturition. Patient passed urine every two or three hours during the day and several times during the night. The urine was cloudy and "thick." These vesical symptoms have continued up to the present time, notwithstanding frequent irrigations of the bladder and the advantages of a change in climate. There has been progressive loss of flesh and strength and increasing anæmia.

Examination on Admission.—There was a tender rounded mass in the left lumbar region, extending from the level of the crest of the ileum below to beneath the costal arch above and to within one and one-half inches of the median line internally. The mass was lobulated, of elastic consistence, and slightly painful on pressure. The lower segment of the costal arch was distinctly rigid, and pressure on it elicited pain. By percussion the descending colon was found to lie anterior to the tumor. The mass descended slightly on respiration. Catheterization of the ureters by Dr. F. Tilden Brown elicited the fact that the urine from the right kidney was normal, while that from the left was scanty and contained large amounts of pus and cheesy material. Examination failed to detect the presence of tubercle bacilli in the urine of either kidney. The trigone was the site of numerous patches of ulceration, which were

most abundant around the mouth of the left ureter. The patient's temperature varied between 100° and 104°, the pulse between 100 and 120. There are the physical signs of a healed tubercular process in the upper part of the left lung.

Operation (Chloroform, followed by Ether).—The left kidney was exposed by a vertical incision along the edge of the erector spinæ, from the lower extremity of which a horizontal incision extended forward toward the umbilicus. The perirenal fat was scanty. The kidney was easily enucleated. It was double the normal size and irregularly lobulated, presenting the appearance of a multilocular pyonephrosis. The pedicle was ligated with heavy catgut. The ureter was traced downward to a point below its crossing of the external iliac vessels and was removed. It presented a beady appearance, and the part which crossed the brim of the pelvis was materially thickened and intimately adherent to the posterior parietal peritoneum and the iliac vessels. Irrigation of the wound followed by closure with chromic gut in layers, a cigarette drain having previously been inserted in the lower angle.

Post-operative.—The patient reacted well from the operation. During the first forty-eight hours there was considerable nausea, but the patient retained a moderate amount of fluids and passed twenty ounces (plus) of urine daily. Movement of the bowels took place on the third day. The increased frequency of urination persisted, the urine, however, containing a small number of leucocytes only. The temperature varied between 100° and 103°, gradually decreasing and reaching normal at the end of the second week. The wound healed down to the drain. At the end of five weeks patient's general condition was more satisfactory than just prior to the operation.

November 20. Since last note patient has been gaining rapidly in strength. The sinus had closed and reopened. To-day patient developed what proved to be a pleurisy with effusion on the left side. After three weeks this subsided, leaving the patient very weak. Slow convalescence.

December 1, 1903. For the past six months the general condition of the patient has steadily improved. She has completely recovered, with the exception of the persistence of the increased frequency of micturition at night, which, however, is not painful.

Case XX.—W. S.; male; aged nineteen; admitted to the Presby-

terian Hospital May 18, 1903. General health has always been excellent. About two months ago patient was seized with severe sharp lumbar pain. Shortly afterward the urine became cloudy. The pain at first was not sufficiently severe to interfere with the pursuit of the patient's studies. At the end of a month patient was compelled to give up work, and consulted a physician. An exploratory lumbar incision was made in the lumbar region over the right kidney by a surgeon in a neighboring city, which was completely closed by suture, healing by primary union within three weeks. The symptoms continued, and to the pain were added chilly sensations, and an irregular febrile movement with progressive loss of flesh and strength. Recently a tumor in the right flank has been noticed.

Examination on Admission.—There was a distinct bulging of the right flank, which is found to be occupied by a tumor reaching down into the right iliac fossa, extending upward beneath the right costal arch and as far forward as the edge of the rectus. It was smooth, highly elastic, and by bimanual examination fluctuation can be elicited. It is moderately tender. By percussion, the ascending colon lay anteriorly. There was well-defined rigidity of the lower segment of the right costal arch, and pressure on it causes pain. The temperature varies between 100° and 103°; the pulse varies between 90 and 110. There is leucocytosis. The urine was high-colored and contains only a small number of leucocytes, although previously it had contained considerable quantities of pus.

Operation (Gas and Ether).—The cicatrix of the previous operation was excised by an elliptical incision, which was deepened until the perirenal fat came into view. The enlarged kidney, surrounded by a very small quantity of fatty tissue, was readily enucleated, and its pedicle ligated with heavy catgut. The organ was more than double the normal size and was the site of a number of abscesses, one, consisting of the dilated pelvis, of very large size. The temporary plugging of the ureter, which was in other respects normal with cheesy tubercular material, accounted for the fact that the bladder urine contained a small number of leucocytes only. The wound, after irrigation with salt solution, and the insertion of a cigarette drain in its lower angle, was closed by chromic-gut suture.

Post-operative.—The patient reacted well from the operation. There

was no nausea. There was no diminution in the daily amount of urine. The temperature rapidly decreased, becoming normal at the end of the first week. The wound healed kindly, and at the time of discharge had almost closed. The patient's general condition continued to improve, and he left the hospital much stronger than he was at the time of admission.

December 1. The sinus has closed and reopened once or twice. His general condition has steadily improved.

Case XXI. Perinephritic Abscess.—M. P.; female; aged fifty-nine; admitted to the hospital October 23, 1902. Previous history negative. Three weeks ago, without known cause, slight tenderness appeared in the left lumbar region, with increasing prostration and loss of appetite. There was an irregular febrile movement. The bowels were regular, and urination was normal and regular. Four days ago the patient noticed a lump in the left flank. The prostration has confined the patient to bed for the past week. The chief complaints are the pain and the prostration.

Examination on Admission.—The left ileo-costal space was the site of a bulging mass, most prominent posteriorly. In front it extends to the margin of the rectus muscle. Behind, the overlying skin was slightly reddened and the tenderness most marked. There was rigidity of the lower segment of the costal arch. The tumor was everywhere dull, except where the descending colon passes anteriorly. The temperature was 101°, the pulse 100, and there were 30,000 leucocytes.

Operation (Gas and Ether).—An incision beginning near the border of the erector spinæ muscle and passing obliquely forward and downward in the ileo-costal space, was made over the most prominent part of the tumor. With the division of the transversalis fascia, a large abscess cavity was opened, the pus being of dark-brown color and very foul. By bimanual examination the kidney could be felt anterior to the wall of the abscess cavity. The cavity was thoroughly irrigated with saline solution, and after the insertion of a good-sized rubber drain in the most dependent angle of the wound, its extremities were closed by interrupted chromic-gut suture.

Post-operative.—There was immediate relief of the pain and tenderness and a gradual subsidence of the fever. The abscess cavity rapidly contracted, and at the time of discharge, three weeks later,

only a sinus two inches in depth remained. This subsequently closed.

June, 1903. Patient has enjoyed excellent health during the past six months.

Case XXII.—M. C.; female; aged twenty-eight; admitted to the Presbyterian Hospital October 2, 1903. Patient has always been a moderate tea-drinker. Previous history negative until five months ago, since which time the appetite has been poor and the patient has been disinclined to eat solid food. There was no pain or vomiting, however, until one month ago. At that time a sharp shooting pain developed in the epigastrium, coming on suddenly in attacks of several minutes' duration without reference to the ingestion of food, and radiating in every direction. These symptoms were not sufficient to confine the patient to bed, nor was there any vomiting until the night before admission. At that time the pain suddenly became very intense, and vomiting developed and was continuous. There was syncope, and the patient was obliged to discontinue work. The vomitus consisted of partially digested food, and afterward of mucus. At no time was there hematemesis or blood in the stool.

Examination on Admission.—The entire abdomen was distended and very rigid, the rigidity being most marked in the upper left quadrant. There was increased resistance of the left costal arch, the rigidity being most pronounced in its upper portion near the junction of the eighth and ninth costal cartilages. The abdomen was everywhere tender, especially at a point about three inches above the umbilicus and just to the left of the median line. The abdomen was everywhere tympanitic, and there was loss of liver dulness. The patient lay in the dorsal position with the thighs flexed, and any lateral movement of the trunk or extension of the thighs was very painful. The pulse varied from 105 to 120, the temperature ranged around 101°. The patient's general condition bordered on collapse.

Operation (Gas and Ether).—Median incision, extending upward from the umbilicus a distance of three inches. The opening of the peritoneal cavity permitted the escape of a large amount of gas, which was free from odor. A small amount of serous fluid of neutral reaction was sponged away from the anterior surface of the stomach, which presented in the wound free from adhesions. The depression of the

anterior surface of the stomach from the parietal peritoneum in the direction of the pylorus was followed by the escape of an increased amount of fluid of neutral reaction. It was more turbid than that originally observed on opening the peritoneal cavity. The pylorus was, however, free from perforation. Through a small opening in the gastro-colic omentum, the posterior surface of the stomach and the lesser peritoneal cavity were then found to be normal. The stomach was now depressed toward the cardiac extremity, and the escaping fluid became markedly increased in quantity as well as in turbidity, and contained particles of partially digested food, disclosing shortly the presence of a perforation about three inches from the cardia and midway between the greater and lesser curvatures. The adjacent fluid was of distinctly acid reaction. The perforation was about the size of a lead-pencil, and the edges of the orifice were well defined and soft. No induration could be detected in the adjacent stomach-wall. A purse-string suture of chromic gut was taken in the healthy wall of the stomach and the orifice closed. Two Lembert sutures of silk were then inserted over the tightened purse-string suture, and the adjacent peritoneal cavity carefully cleaned. After the insertion of drains down to the pylorus and point of perforation, the remaining portion of the abdominal wound was closed.

Post-operative.—Some nausea and vomiting for twenty-four hours. The pain greatly diminished, and the patient felt very much more comfortable. The evacuation of the free gas in the peritoneal cavity was directly followed by the disappearance of the distention, and the lower half of the abdomen remained flaccid and free from rigidity throughout. The pulse ranged around 120, but was of very much better quality than prior to the operation. The temperature remained below 101°. There was no discharge of stomach contents from the wound, and the patient received increasing quantities of fluid nourishment without pain or discomfort. During the second twenty-four hours the pulse had decreased to 80, and thereafter the progress was very satisfactory.

October 12, 1903. Patient's temperature to-day suddenly rose to 103.5°, the pulse to 120, and in the course of the next forty-eight hours the physical signs of consolidation of the lower left lobe developed with a serous effusion in the left pleural cavity. This complication ran its

regular course, terminating in resolution on the twelfth day. Shortly after, the temperature became normal, and further convalescence was uneventful. At time of discharge the sinus persists, but is superficial, and the patient's general condition is satisfactory.

Case XXIII.—P. G.; male; 27; soldier; admitted to the Gouverneur Hospital June 15, 1903. Previous history negative. Patient denied ever having had syphilis. On the day of admission to the hospital, patient, who had hitherto always enjoyed excellent health, was seized with paroxysmal pain in the left abdomen. The pain, most intense on the left side, radiated down the left thigh as far as the knee and also to the opposite side of the abdomen. The patient was obliged to cease work immediately and came to the hospital to obtain relief from the pain, a relief afforded only by the hypodermic use of morphine.

Examination on Admission.—There was a large pulsating tumor occupying the left side of the abdomen. The pulsation was synchronous with the heart-beat and of an expansile character. On palpation the tumor had a smooth surface, and by bimanual examination could be distinctly felt to completely fill the entire lumbar region, extending from the crest of the ileum below to the costal arch above. There was rigidity of the left costal arch, most marked in its lower posterior portion. On auscultation, a distinct systolic bruit could be heard over the tumor. There was no disturbance of the circulation in the lower extremities, nor any asymmetry of the posterior tibial pulse.

June 21. There had been no change in the size of the tumor since admission. The pain is so intense that willing consent is given for an exploratory operation. This was undertaken in the hope that an aneurism of the renal or other branch of the aorta might be found, which then could be removed by ligation and excision.

Operation (Gas and Ether).—The abdomen was opened by an incision along the outer border of the left rectus, extending for an equal distance above and below the umbilicus. The aneurismal sac was in close contact with the parietal peritoneum and had a thin wall. It extended from the spleen above to the iliac fossa below, and involved the aorta from a point just below the diaphragm to within two inches of the bifurcation. The abdominal incision was closed with some difficulty owing to the pressure of the sac against the abdominal wall.

For one week the patient experienced great relief from the pain.

Then the pain recurred with its former intensity. Three weeks after the operation rupture of the sac took place through the upper part of the healed incision, and death resulted from hemorrhage.

REMARKS.—The cases of surgery of the liver here reported constitute a very large group of those cases in which the symptom of costal resistance may be elicited. In those of acute character, such as abscess and inflammation of the gall-bladder, the symptom has been invariably obtained. It has also been obtained in many other cases of cholecystitis, the histories of which are purposely omitted because no confirmation of the pathological condition could be obtained, resolution either taking place or no operation being performed. In many cases of chronic inflammation, especially those associated with cholelithiasis in which the diagnosis was confirmed by an operation done in the interval between attacks, no costal resistance could be obtained, although the wall of the gall-bladder was found in a thickened condition and otherwise showed chronic inflammatory changes.

In neoplasm, the symptom is of value only when the liver is materially increased in size, as in Case VII; on the other hand, in cases of carcinomatous metastasis no definite change in the degree of costal resistance can usually be elicited, although the mass may not infrequently be palpated below the border of the arch.

Such malignant growths are, however, rarely if ever operable, whereas in abscess and acute cholecystitis, operation is not infrequently imperative. It is precisely in this latter group of cases in which the presence of increased costal resistance is most constant. It is here often of the greatest value in making a differential diagnosis between acute liver and gall-bladder affections, on the one hand, and acute appendicitis on the other, especially when the inflammatory process is so intense as to provoke symmetrical contraction of the entire rectus muscle. Under these circumstances the presence of costal resistance almost always excludes appendicitis.

It is also desirable to call attention to the fact that, in subacute cholecystitis, manifested by local pain and tenderness with complete absence of all constitutional symptoms, a considerable degree of costal resistance is present.

Any detailed reference to the clinical features of these cases is foreign to this paper. At the same time, Case XV, in which an abscess

developed in the left lobe of the liver some three or four weeks after the evacuation of a large abscess in the right lobe; Case XIV, in which typhoid fever was complicated by the formation of multiple abscesses in the right lobe; Case IX, in which acute cholecystitis existed without the presence of calculus, and Case VIII, in cholelithiasis in the quiescent stage in which pressure on the overlying costal arch elicited marked tenderness, are all worthy of special mention. In addition, the extreme variability in the clinical history of the early stages of cholelithiasis not only with reference to the local symptoms but also to the constitutional symptoms as well, should be emphasized.

Only one opportunity has been afforded to observe the behavior of the costal arch in acute pancreatitis. In this case, the presence of increased costal resistance was very pronounced, and indicated more than any other symptom the most advantageous incision for the diagnosis and relief of this most serious lesion. The case to which reference is made is also noteworthy in that prior to the operation, as well as for twenty-four hours afterward, the general condition of the patient was most unfavorable to recovery, the radial pulse being nearly imperceptible, and requiring several clyses and infusions.

In cases of pancreatic cyst, the symptom of increased costal resistance occurs only when the cyst is so situated or has reached such dimensions as to lie beneath a segment of the costal arch. In the case here reported, the extraordinary size of the cyst accounted for the unusual prominence of this symptom.

The observation of this symptom in perforation of the stomach is unfortunately limited to one case, although this is of considerable value in that, notwithstanding general rigidity of the entire abdominal wall, the resistance of the upper portion of the left costal arch was so much greater than the corresponding segment of the right side, that no hesitation was felt in making the incision above the level of the umbilicus. Shortly after, another opportunity to test this symptom occurred in the case of a perforating ulcer in the anterior wall of the second part of the duodenum. Here again the entire abdominal wall was rigid, even when the patient was resting under the influence of morphine; the upper portion of the right costal arch, however, presented increased rigidity, and accurately determined the location of the incision.

Those pathological conditions of the kidney in which this symptom

can be elicited are those in which the organ is increased in size or in which there is perinephritic abscess. The writer has not yet had an opportunity to test the value of this symptom in acute pyelonephritis, a condition in which the size of the kidney, although greatly inflamed and the site of numerous abscesses, may yet be but slightly increased. One would naturally expect, however, to find this symptom in cases of this description.

In all cases of enlargement of the kidney, whether of an inflammatory or neoplastic character, the increased resistance is invariably most pronounced in the lower segment of the arch, and may be elicited with the patient in either the dorsal position or reclining on his side.

In several cases of calculi in the pelvis of the kidney which were removed by the writer during the past eighteen months, no change in the resistance of the lower costal arch has been noted. On the other hand, in two cases of intermittent hydronephrosis associated with movable kidney, the increased costal resistance was very pronounced. Also in one case of malignant growth of the adrenal, which was of large size, and partially cystic, the presence of this symptom was noted, although the character of the resistance was considerably less elastic than usual.

A careful analysis of the cases here reported establishes the following conclusions:

(1) That the symptom of costal resistance may always be elicited in the acute and subacute inflammatory processes of the contiguous underlying organs. In chronic inflammation of these same organs it is present irregularly, either generally, when the organ is increased in size, or during a transitory exacerbation of the chronic inflammatory process. In neoplasms or cysts, increased costal resistance may be obtained only when the tumor has reached a sufficient size to mechanically interfere with the movement of the arch.

(2) That the degree of resistance is in direct ratio to the intensity of the inflammatory process.

(3) That the increase of costal resistance is most marked in that segment of the costal arch which is most closely situated to the original point of infection, or, in the case of a neoplasm, to that part of the arch which lies over the most prominent part of the tumor.

(4) That its value as a diagnostic symptom is greatest in pathological conditions invading the upper half of the abdominal cavity, especially of the liver, the stomach, the pancreas, the gall-bladder, the spleen, the duodenum, the kidneys, and in extensive aneurism of the abdominal aorta. The writer has had but little opportunity to observe this symptom in supradiaphragmatic processes. In cases of empyema, the abscess cavity is generally encapsulated and does not usually occupy the lowest part of the thoracic cavity. Only when so situated is there resistance of the costal arch proper. In higher positions, any difference in the rigidity of the overlying rib or ribs is very difficult to detect and unsatisfactory.

(5) That the presence of asymmetry in the elastic recoil is very much less frequently observed than asymmetrical increase in the costal resistance, the former being present only in cases of cysts, neoplasms, and inflammatory exudates in which the acute symptoms have subsided, while it is invariably absent in all the acute and subacute inflammatory processes.

(6) That with the subsidence of the inflammatory process, whether by radical or palliative procedure, the costal resistance again returns to its normal condition.

(7) That the presence of this symptom is very valuable not only in facilitating accurate diagnosis, but also in serving as a useful guide to that incision through which the inflammatory focus may be most rapidly exposed and satisfactorily treated.

(8) Finally, that proper and skilful technique in determining the presence or absence of this symptom may be easily acquired, and that, therefore, the application of the symptom may be utilized by the general practitioner and not confined to those engaged in the pursuit of any particular specialty.

III.

LINEÆ ATROPHICÆ, ASSOCIATED WITH RAPID GROWTH OF LONG BONES.

By W. P Northrup, M.D.

In May, 1903, I reported to the Association of American Physicians, at its annual meeting in Washington, two cases—"Skin Lesions Associated with Rapid Growth of Long Bones," or "Lineæ Albicantes," ("Les Vergetures de Croissance," Jules Comby).*

Shortly after return to my service in the Presbyterian Hospital, a similar case developed in the ward, and we were privileged to watch the progress from day to day.

A. B.; American; female; aged fourteen years; entered the ward on May 26, with pericarditis and broncho-pneumonia. Previously healthy. She was a school-girl, rather under-sized, and had never menstruated.

Her present illness dated back two weeks, her history mentioning malaise, pains and tenderness in knees, ankles, and shoulders. These were rather indefinite and had largely passed away at time of entrance, leaving no result.

She was fairly nourished, pale, and the superficial glands of axillæ and groins were enlarged.

Her symptoms were connected with the heart and lungs, pericarditis and bronchitis, also some pains and stiffness of joints. Her physician sending her to hospital believed she was developing typhoid fever.

The patient gradually emerged from this indefinite mixture of signs and symptoms which indirectly pointed to a general poor condition, and apparently began to grow. It was estimated that she grew several inches while in hospital. Such was the testimony of her clothing and the estimate of her parents. While in hospital she, of course, remained mostly in bed.

* See Transactions of the Association of American Physicians, 1903; also The Medical News, October 31, 1903.

FIG. 1.—Les Vergetures.

After one month in hospital and in bed, there were noticed on the inner aspect of her left knee two parallel lineæ atrophicæ over the lower femoral extremity, running transversely to the axis of the long bone at the juncture of shaft and epiphysis. These lines were similar to those of the skin over the rapidly enlarging abdomen of the pregnant woman. They were dark purplish-red, and in contrast to the skin favorable to photographing. (See illustration.)

The lineæ atrophicæ multiplied in number, the lines being similar in character, symmetrical on the inner surfaces of the two knees.

The father, noting the interest taken in the lesion, volunteered the information that he had similar lines on his own knees. This proved to be the fact, the lines being similar in all respects save that his, being old, were no longer purplish, but had become porcelain-white. Photographs taken of his lines were so indistinct as not to serve for illustration. He declared that the lines came at the age of fifteen, that he had been sick with typhoid fever (*Nervenfieber*), and that he was in bed many weeks and noted the vergetures when he first dressed and got up.

As another illustration of how "things come in twos and threes," it may be noted that at the same time similar markings were observed on the knees of a young patient in one of the private corridor rooms.

She was sixteen years of age, decidedly under-sized and undeveloped. When she sat up she noted four bands or lines, reddish striæ. Could not tell whether she grew. No means of comparison.

Photographs of older cases, when the skin scars have become white, showing little contrast with normal skin, are difficult to reproduce. The case A. B. developing in the ward, and having in the early state the purplish color, was particularly favorable to photography and to reproduction by illustration.

The elements of these cases are summed up in Jules Comby's book, and I have never seen so full an account elsewhere.*

"All acute and chronic illnesses, febrile or apyretic, which condemn a child whose growth is not yet terminated, during a long time, to horizontal rest, has for habitual result very remarkable growth in height. A child which presents each year an average growth of 5 cm. often passes this limit in some weeks, under the influence of a typhoid fever,

*Maladies de Croissance. Traité des Maladies de L'Enfance, fourth edition. Paris, 1902.

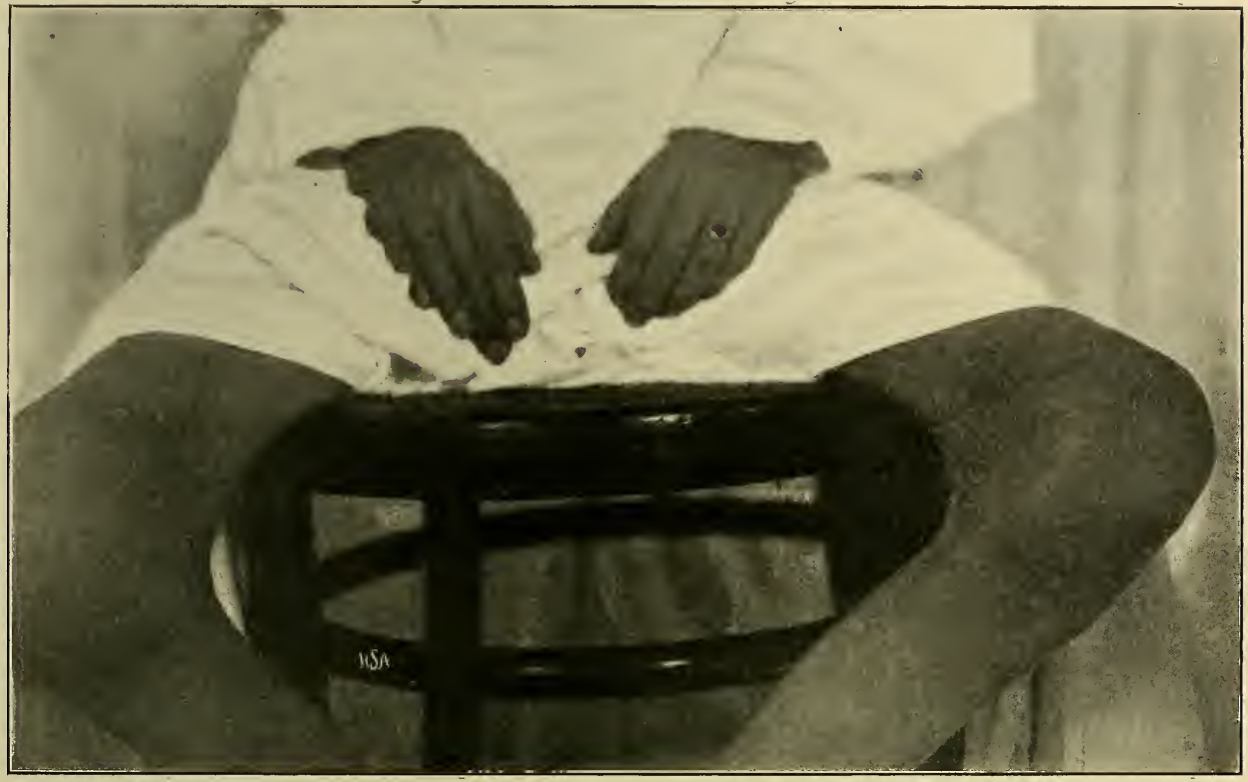

FIG. 2.—Les Vergetures.

for example: An elongation of the long bones is so rapid in such cases that the development of the skin is not able to keep pace, and there result frayings (éraillures), wales, welts (vergetures), the habitual location of which corresponds to the femoro-tibial regions. The accession of growth is explained by the horizontal position, which results in annulling the reciprocal pressure of the bones and by the irritative congestion of the bony marrow which typhoid fever generally produces." *

Under Typhoid Fever, he speaks of a girl, aged thirteen years, who suffered several relapses of typhoid fever, who was in bed four months, recovered with rapid growth and pronounced welts (belles vergetures).†

"It is not rare to see a child present as a result of typhoid fever a rapid and excessive growth. Such growth shows itself sometimes, besides elongation of the skeleton, in cutaneous welts (vergetures), having for their location the knees, and may occupy also other parts of the body."

The two cases reported previously were convalescents from typhoid fever, thirteen and seventeen years of age; both patients grew very rapidly, their cases corresponding closely to Comby's description. Both showed vergetures above the knees, and one also showed them above the elbow. Of the five cases here referred to, adolescence, convalescence from acute infectious disease, prolonged rest in bed, rapid growth, are well established in at least four.

The location of the lineæ atrophicæ have been found over the points of greatest bone growth, namely, lower end of the femoro and humeri. The lineæ are first purplish-red, becoming later porcelain-white. They are in every way similar in appearance to those of the pregnant woman's abdomen.

"The same causes which make frayings of the skin in the rapidly growing abdomen of the pregnant woman, may act in a similar way in the rapidly elongating long bones of the leg in the particular combination of youth, typhoid fever attended by its exaggerated growth of bone, and enforced horizontal rest. Literally, it would seem that the skin cannot keep pace with the bones, and frayings result."

* Loc. cit., p. 267. † Loc. cit., p. 113.

IV.

A CASE OF TUMOR OF THE SPINAL CORD.

By George Woolsey, M.D.

Cases of spinal-cord tumor diagnosed, localized, and operated upon are of sufficient interest to justify the report of the following case of tumor in the cervical region, successfully diagnosed, localized, and operated upon.

Mrs. S.; aged thirty-four; was referred to me for operation by Dr. Joseph Fraenkel of this city, to whom I am indebted for the following history as well as for the accurate diagnosis and localization.

In September, 1901, a fall into a ditch caused a bruise of the left hip and ankle. On October 23, 1901, she noticed that jolting in the cars caused pain in the left shoulder, at first dull and not very severe. This increased in severity and extended to the other shoulder, with pain in the back of the neck joining the two painful areas. It became shooting, and extended to the chest in knife-like radiations.

In November, 1902, weakness of the left upper extremity was noticed in piano-playing, and simultaneously a band-like sensation was felt around the upper abdomen, most marked when she wanted to get up. Soon afterward there was weakness of the left lower extremity. Later, sensation on the right side was impaired. Sphincteric difficulties, not amounting to actual incontinence, have been present for the past month.

On examination in the latter part of January, 1903, the following points were noted:

1. Pain across shoulders and back of neck, slight all the time, worse in the morning and when sitting up without support. No severe shooting pains for the past month.
2. A girdle sensation across the upper abdomen, getting worse.
3. Tingling in hands, like electricity, more marked in left.

4. Difficult motion of the left upper and lower extremities.

5. She is most comfortable lying on the left side; contractions are worse on the right side.

6. Left fingers and toes straighten out and draw up painfully when she tries to sit up.

Furthermore, there is atrophic and flaccid paralysis of the left upper extremity, most marked in the triceps and extensors; spastic paralysis of the left lower extremity; exaggerated knee-jerk and the presence of ankle clonus and Babinsky phenomenon; and on change of posture a spasmodic stretching of left hand and foot.

As to the sensory symptoms, there is paræsthesia of the right toes and dissociated sensory disturbances of the right side up to about the fifth thoracic vertebra. At this height and at about the sixth cervical vertebra there is a small band of hyperæsthesia. The pain is worse at night. There is sweating of the face, especially at night. There is some tenderness, especially on left lateral pressure, over the fourth thoracic vertebra. The movement of the head backward gives pain in the back of the neck. The deep sensibility is lost in the left upper extremity.

On February 1, 1903, it was observed that the sensation of the left upper extremity (ulnar side) was not very acute, that the temperature sense was disturbed on both sides of the trunk, and that the muscles of the left hand reacted sluggishly to faradic stimulation.

The diagnosis of a tumor within the vertebral canal was made. There was some difference of opinion among those who had seen the patient as to its relation to the cord and membranes. It was thought probable by most that it was extradural, though an intramedullary situation had been suggested by one neurologist. The tumor was localized at the sixth cervical segment.

She was admitted to the Presbyterian Hospital on February 1, 1903, in the condition described above, except that with the progress of the paralysis she was even more helpless, and could not walk, stand, or raise herself up.

Operation.—Cervical laminectomy was done on February 2, under ether anæsthesia, with the patient in a prone Sims's position. Median incision from 1½ inch below the external occipital protuberance to the first thoracic spine, deepened to spines of vertebræ, from which and the

laminæ the deep tissues and periosteum were reflected by the elevator and knife. The hemorrhage was but moderate and easily controlled by pressure and hot-salt solution on one side, while the opposite side was being reflected. The spines of the fourth to seventh (inclusive) cervical vertebræ were removed by bone-cutting forceps, and the corresponding laminæ by the rongeur, piecemeal. Nothing appeared outside the dura, hence the latter was incised in the median line. The troublesome flow of cerebro-spinal fluid from the cranial side of the opening was checked by inserting a small strip of gauze between the dura and the cord. The probe encountered no resistance except on the left side and anteriorly in the region of the sixth cervical lamina. Here the cord bulged backward considerably, and on pressing it to the right a dark bluish prominent area was seen on the left side, extending anteriorly. As this lay in front of the posterior nerve-roots, two of the latter overlying it were cut central to the root ganglia to get at the tumor. The latter was easily distinguished from the cord by its darker color and harder consistence, and appeared to be covered by a capsule continuous with the pia, which was incised along the curved line where the tumor and the cord adjoined. The tumor, which was also adherent to the inner surface of the dura, was then fairly easily removed entire by blunt dissection, chiefly by the finger. It measured 2 cm. in length, $1\frac{3}{4}$ cm. in width, and $1\frac{1}{4}$ cm. in thickness, and was opposite the sixth cervical lamina, overlapping that of the seventh. The dura was sutured with fine gut and the deep parts were brought together by interrupted sutures of heavy gut, a small cigarette drain being introduced at the lower angle as far as the dura.

The patient continued in excellent condition throughout the operation, but on coming out of ether the paralysis was more marked than before, especially on the left side, and for some time after the operation she complained of paræsthesia, especially prickling, which was most troublesome in the upper extremities. Profuse perspiration of the head was also very annoying.

The wound healed *per primam*, and it was two weeks or more before any marked improvement was noticed. This consisted in the return of motion, first in the right and then in the left leg. The left arm improved but slightly and slowly. For the first two weeks there was more or less incontinence. When she left for home, six weeks after the

operation, sensation was about as before, except that the girdle sensation was not present. Considerable improvement had occurred in motion. There was spasticity of both lower extremities.

A month later she was sitting up, could get out of a chair without assistance and walked with a spastic, paretic gait. Considerable paresis of the triceps and the extensors and flexors of the wrist remained. There was loss of deep sensibility and of the stereognostic sense in the left hand. The paræsthesia was but slight.

Four months after the operation she walked without assistance with a spastic gait. Disturbances of sensation were less marked.

Seven months after the operation the motion in the left upper extremity had also improved considerably.

She has continued to improve still further.

Dr. Ewing pronounced the tumor to be an endothelioma.

This case in point of locality, in the cervical region, belongs to the rarest class of spinal-cord tumors. In the series of operated cases collected by Starr, Bruns, Putnam, and others, only one was located in the cervical region. Three such cases have been more recently reported by Oppenheim and Sonnenburg,[1] Henschen and Lennander,[2] Putnam Krauss and Park.[3] In the above series also the operations on extradural tumors have far outnumbered those on intradural ones, although in fourteen cases recently reported the intradural have far outnumbered the extradural. The former most often allow of an exact diagnosis, and hence a good result from an operation. Hahn,[4] in 1902, reported the ratio of intradural to extradural tumors to be two to one.

In this report it is unnecessary to fully discuss the question of diagnosis, which depends upon a regular and oftentimes slow development that shows itself in an orderly sequence of symptoms due to pressure. The tumors are, as a rule, situated laterally, or laterally and posteriorly, and the pressure is usually first shown in the posterior nerve-roots as vague and then localized neuralgic pains, at first on one side, then on both, finally giving place to diminished sensation when the nerve-roots are destroyed. The symptoms of pressure on the cord itself may not occur until after a long interval (several years), and consist of (1) motor weakness beginning below and extending upward, at first on the side of the tumor, paraplegia only developing later. Then (2) diminution of sensation of all kinds but in different degrees occurs, advancing

from below upward and being most pronounced on the side opposite the tumor. Thus Brown-Séquard's paralysis is not infrequently observed in these cases. At the upper border of the hypæsthesia there is hyperæsthesia in a small circular zone or in spots.

The question of segment diagnosis is of the greatest importance and interest, for on this depends the resort to operative removal. The upper limit of the tumor is the most important to locate, as it has been a common experience since Horsley's first case to find the tumor higher than it was diagnosed. To determine this limit, and the segment or segments involved by the pressure, we have both the motor and sensory symptoms. The sensory are more important than the motor symptoms for this purpose, and those of sensory paralysis (anæsthesia, etc.) than those of sensory irritation. In this connection it is important to observe that, according to Sherrington's experiments, each nerve-root is intimately connected with those above and below, and, owing to this and the numerous anastomoses between the nerve-trunks, no one muscle or area of skin is supplied by a single root or segment, but in addition by the segment or root above and below, so that the tumor may be placed two segments higher than the symptoms. Hence Bruns says the operation should be done two segments above the upper level of pain, and, according to Starr, the cord should be exposed four inches higher than the level of the spinal nerve in which the pain is found. Furthermore, the afferent and efferent tracts run in the substance of the cord for some distance, possibly the distance of two segments, before they reach the nerve-centre in the gray matter. This fact may further increase the ease of mistakes in locating a tumor lower than it really is.

Jaffe,[5] in reporting an autopsied case, found that the tumor was in the spinal segment which governed the upper limit of the area of diminished sensation or the transition from the diminished to the normal sensation, supplied by the anastomoses of the intact roots above.

Schede,[6] in reporting four cases operated upon, states that the upper end of the tumor was regularly found in the segment which represented the upper border of the disturbance of sensation.

The diagnosis of the nature of the tumor is more difficult than its position. Sarcomata are the most common variety, forming forty-five per cent. according to Bruns's statistics, forty-two per cent. according to Putnam's and Warren's. Extradural growths are more apt to be

malignant than intradural. Those progressing rapidly are probably malignant. But in the case of any tumor within the spinal cord, as within the cranial cavity, the prognosis is necessarily fatal if the tumor is left to itself.

Laminectomy in itself is not a very serious operation, and according to McCosh the operative mortality should not be over ten per cent. The fact that resort to operation has generally been delayed too long, until the cord is seriously compromised, bed-sores or cystitis have developed, and the general condition has greatly deteriorated, is responsible for the high mortality. Bruns gives thirty per cent. of recoveries, Krause 56.3 per cent., and in the last twelve cases operated on seventy-five per cent. The prognosis is worse the higher the tumor is situated. Spinal tumors are more often removable than cerebral ones. According to Starr,[7] out of 122 cases the operation should have been feasible in 76, and from pathological reports the tumor could have been removed in seventy-five per cent. Thus these tumors are far more accessible than cerebral tumors.

In considering the *operative treatment* it is well to repeat the statement of Starr and McCosh, that although compression from a tumor of the cord may exist for a long time without softening, no delay should be made for antisyphilitic treatment, for gummata of the cord are rare and the results of delay may be most unfavorable.

As it is, strictly speaking, impossible to assign a certain lesion to a definite segment, but only to an area within three segments, hence, given the highest segment of the cord opposite which the tumor may be situated, we expose this by removing the neural arches of not less than three vertebræ, and any slight inaccuracy of localization may be counterbalanced by the length of the area of the cord exposed. At least this much has to be exposed for the proper manipulations in the removal of the tumor. For operative purposes the surgeon must know the relations of the segments to the vertebræ and really to the spines of the vertebræ, for these are our only superficial landmarks, and in the cervical region even these fail us. These relations of the cord segments to the vertebral spines are given in various tables with a fair degree of accuracy, though if the considerations already given do not suffice to explain the frequency of the tumor being found higher than located, some inaccuracy in these tables or even an individual difference may account for it.

As to the technique, even in the deep wound in the cervical region hemorrhage was not serious and was easily controlled. It is a matter of individual preference what one uses for the removal of the laminæ. Cutting forceps for the spines and rongeur forceps for the laminæ I have found effective. Schede recommends the Gigli saw in the cervical region to divide the laminæ. Uhtoff's osteoplastic resection is to be condemned. It prolongs and complicates the operation, and the laminæ and spines do not serve to carry any of the weight. Hence no support is necessary after the operation.

Sonnenburg[1] has reported one case of a tumor in the cervical region of the cord in which he attributed the fatal result to the use of this method of temporary resection.

The flow of cerebro-spinal fluid may be a great inconvenience in the removal of the tumor. In my case, a little sterile gauze inserted behind the cord between it and the dura at the upper or cephalic end of the incision checked this flow very satisfactorily. For the same purpose Schede has used the circular constriction of the dural sac above and below the incision by a silk or elastic ligature, as proposed by Sick.

The tumor is usually readily shelled out by blunt dissection. In the above case two posterior nerve-roots had to be divided to get at it.

The improvement, as in the case reported, may not commence until two weeks or more after the operation. It appears first and is most complete on the side where the symptoms last appeared. The symptoms continue to improve for a considerable time, but some permanent effects of the pressure may persist from destruction of the cord on the side of the tumor, depending on the size of the tumor and the length of time it has exerted pressure. For this reason alone it cannot be too strongly urged that suitable cases of tumor of the spinal cord be operated upon as soon as it is possible to localize them.

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V.

THE PATHOLOGICAL ANATOMY OF SHIGA BACILLUS INFECTION OF THE INTESTINE IN INFANTS.

By John Howland, M.D.

[To this Essay was awarded the Briddon Prize Medal for 1903.—Eds.]

The bacillus of dysentery (Shiga), first proved by Shiga[1] to be the cause of epidemic dysentery of Japan, has been shown by the work of Flexner, Kruse, Muller, Drycke, and others to stand in direct causal relation to the dysenteries epidemic, endemic, and sporadic of the tropical and temperate zones, and its etiological importance is now universally recognized.

The pathological lesions in adults induced by infection with this bacillus were briefly stated by Shiga[2] to be more superficial than those caused by the amœba coli, and he noticed that while the mesenteric glands were regularly enlarged, the spleen, unless some complication was present, was unaffected.

Flexner[3] reports briefly the autopsies of three cases in Manila, the lesions consisting in swelling, congestion, and hemorrhage into the mucous membrane, with slight exudation on to the surface in one case and very small ulcerations in another. He states that histologically "the changes appear in the mucous membrane, submucosa, and muscularis, being most marked in the former situations. Those of the mucous membrane consist of coagulative necrosis with exudation of fibrin and polymorphonuclear cells. . . . The pseudo-membrane is a close-meshed network of fibrin enclosing multinuclear, often fragmented, cells. . . . The submucosa is always much altered. . . . Here are found hemorrhages of variable size, while in the interstices of the tissue some fibrin appears. More marked, however, are cellular accumulations which are present, not uniformly, but in irregular areas. . . . The character of the cellular exudate is quite uniform. Ex-

cluding the red blood-cells, the new cells consist chiefly of plasma cells. . . . In the submucosa, infiltration, hemorrhage, and fibrin formation take place also, beneath an intact or almost intact mucous membrane. . . . The muscular coat shows only hemorrhages. . . . The peritoneal tunic is usually unaltered."

He emphasizes the fact that the polymorphonuclear leucocytes play a very insignificant rôle in the process of infiltration in the submucosa, whereas in the affected mucous membrane they are much in evidence. The bacteria were abundant in the fibrinous exudation on the mucous membrane and in the necrotic tissue; he could not find them in the unaffected tissue, and believed the changes in the submucosa to be toxic in origin.

Strong and Musgrave [4] give a summary of the changes observed in many autopsies performed by them in Manila. They found the changes mostly in the large intestine, but extending usually for a variable distance into the ileum. The whole wall of the intestine was thickened. The superficial part of the mucosa was necrotic, and usually hemorrhages were found beneath this. The solitary follicles were swollen and red. In the very acute cases no definite ulceration was observed, but only a general superficial necrosis of the mucosa. Microscopically there was necrosis of the mucous membrane with distention of the blood-vessels and extravasation of blood. An extensive cellular infiltration of the mucosa was the rule, and there were hemorrhages into the submucosa and œdema of the same. Plasma cells were increased, especially around the blood-vessels. Œdema was found even in the muscular coats. The mesenteric glands were uniformly much enlarged. Bacilli of typhoid-colon form and staining properties were found in the mucosa and cocci, often mixed with them, and though the latter were only superficially situated, the bacilli were found sometimes not only in the mucosa but all through the areolar tissue, the muscularis mucosæ and submucosa down to the muscular coats. In the other organs there were no constant changes. No mention is made of fibrin.

Duval and Bassett,[5] in a preliminary paper, first pointed out the relationship between the bacillus of dysentery (Shiga) and the summer diarrhœas of infants. They reported forty-two positive cases.

Wollstein [6] reports the finding of the bacilli in thirty-nine cases of infantile diarrhœa occurring during the winter months out of one hun-

dred and fourteen studied, but many of the negative cases were normal children, and in all cases having blood and mucus in the stools the bacilli were present.

Numerous other cases in addition have been recorded, and the bacillus dysenteriæ (Shiga) is now generally accepted as the cause of the majority of the various forms of diarrhœa in children.

The apparent discrepancies in the different types of cultures obtained from various sources have partly disappeared in the light of the observations of Martini and Lenz,[7] [8] who showed by reactions and cultural characteristics that there are at least two types of this organism known to us as the true Shiga (not fermenting mannite) and the "Harris" or "Flexner-Manila" (fermenting mannite). The latter of these is the type chiefly found connected with infantile diarrhœa in New York according to Wollstein, only one of her positive cases being of the true Shiga type.

Gay and Duval[9] have recently reported three cases in adults in which both types of the organism were found, in one case the acid-producing or "Harris" type predominating, in another the alkaline or true Shiga type predominating, and in a third the number of positive tubes being approximately the same. No cases of double infection in infants have as yet been reported. [This statement was true at the time that it was written, but since then at least six cases of double infection in infants have been found.]

The autopsies whose findings I wish to report took place at the New York Foundling Hospital, the Babies' Hospital, and the Nursery and Child's Hospital.

The organism was proved to be present in the great majority of cases by an examination of the stools, but in seven cases it was obtained post-mortem by scraping the mucous membrane of the colon, and in three cases it was obtained both ante mortem and post mortem.

The organism found in all these cases corresponded in all particulars to the type known as the acid or "Harris" or "Flexner-Manila" organism; that is, it did not ferment glucose, saccharose or lactose, but did split mannite with acid formation. It produced an early acidity in milk with a subsequent alkalinity, and agglutinated with the "Harris" serum in high dilutions.

The autopsies were obtained as soon as possible after death, the pieces of the organs placed in equal parts of ninety-five per cent. alcohol and ten per cent. formalin. After from one to three days they were transferred to alcohol and mounted and cut in paraffine. The staining was done with hæmalaun and eosin, sections for bacteria were stained by the Gram-Weigert method, and for those negative to Gram with borax-blue and differentiated with one-half per cent. acetic acid. The Weigert stain for fibrin was used to demonstrate fibrin.

The first seventeen cases were winter cases occurring between November 1 and April 15, and the last fifteen, summer cases, between May 1 and September 1. There seems to be no difference in the histological findings due to the time of year.

REPORT OF CASES.

Case I.—C. S., female; aged ten and one-half months; brought to the hospital and left without any history being obtained. Signs of broncho-pneumonia in both lungs. She did well with this and was apparently convalescent, when on the eighth day after admission she began to vomit and have frequent mucous and bloody stools. These persisted till death, seven days later. Temperature at first 100° to 101.5°, but rose three days before death from 102° to 103°, where it remained. The bacillus dysenteriæ was cultivated from the stools five days before death.

Autopsy.—Showed typical broncho-pneumonia in both lungs, degenerated kidneys, a large, soft hyperplastic spleen, and a moderately fatty liver. Stomach: Normal, as also small intestine, except for slight follicular hyperplasia. The large intestine showed the mucous membrane throughout congested, and it had lost its velvety appearance, but there was no thickening of the wall. Microscopically: The small intestine shows a marked hyperplasia of the lymphoid follicles, due chiefly to an increase in lymphoid cells and less to an increase in endothelioid cells. This hyperplasia extends into the surface mucosa, separating the crypts from each other, and densely infiltrating the stroma. Here are occasional depressions in the mucosa extending into the enlarged follicles, at which points the mucous membrane is deficient. The submucosa is quite normal. The large intestine shows a similar hypertrophy of the solitary follicles with superficial

epithelial defects without reaction. Bacteria: There are few organisms in the sections either positive or negative to Gram, and those seen are very close to the surface.

Case II.—S. M.; female; aged five months; taken sick November 11, and death twenty-five days later. Stools were greenish, with much mucus, never any blood, occasionally watery, one to five a day. Temperature touched 100° only once, the rest of the time 99° or below. Bacillus of dysentery (Shiga) found two weeks before death at first examination.

Autopsy.—Small intestine normal except for extreme lower end, where there is slight congestion. Large intestine: The mucosa is congested throughout, the lower part extremely so, where it is also thickened. Microscopically: Small intestine: Practically normal. Large intestine: Lesions exclusive of œdema and congestion of the mucous membrane are insignificant. Slight lymphoid hypertrophy. Spleen: There is a moderate endothelial hyperplasia of the follicles. Bacteria are found, chiefly bacilli negative to Gram, in the superficial part of the mucosa in considerable quantity.

Case III.—N. D.; male; aged ten months; admitted to the hospital nine days before death, with diarrhœa and with temperature 97°. The stools were one to five a day, yellow and brown, with mucus, and only once a little blood. He failed rapidly, and died very poorly nourished. The bacillus dysenteriæ was cultivated from the mucous membrane of the colon at autopsy.

Autopsy.—The kidneys were degenerated. Liver: Degenerated. Other organs normal except the colon, the mucous membrane of which was very much congested and the submucosa on section seen to be thickened. No apparent ulceration. The mesenteric glands were quite enlarged but only slightly congested. Microscopically: Large intestine: The mucous membrane is much congested, though there are no hemorrhages; the lymphoid follicles are a little swollen; the submucosa is somewhat thickened from œdema and superficial cellular infiltration, especially about the blood-vessels; the muscular layer is normal. Bacteria: On the surface of the mucosa and between the epithelial cells a moderate number of organisms negative to Gram are seen, mostly bacilli of the size of colon bacilli, arranged in small clumps.

Case IV.—T. W.; male; aged five months; was admitted to hos-

pital suffering from intestinal indigestion. During the first month he improved very much and gained some weight, then developed diarrhœa and began to lose weight. A day or two afterward the first trace of blood appeared in the stools, only small in amount, but coincident with this, a rise in temperature from 99° to 103°, and it remained high, sometimes up to 104°, till his death, eight days later. Stools toward the last showed no blood whatever, but were yellowish-green, with much mucus. Toward the close of the disease considerable abdominal rigidity and tympanites appeared. The bacillus dysenteriæ was obtained by culture from scrapings of the intestinal mucosa.

Autopsy.—Liver: Marked congestion with fatty infiltration. Kidneys: Congested and degenerated. Spleen: Congested. Lungs: Hypostatic pneumonia in both. Peritoneal cavity: Contains cloudy serum. Between the loops of intestine there are some delicate bits of fibrin. There is no marked injection of the vessels, and the peritoneum has lost only in part its normal shining appearance. Stomach: Normal. Small intestine: Appears normal except for slight swelling of Peyer's patches and solitary follicles. Large intestine: Shows extensive changes, more marked at the lower end. The wall of the sigmoid and rectum is very much thickened. In the cæcum the mucous membrane has lost its normal smooth appearance interspersed with granular areas and marked congestion. In the sigmoid and rectum the mucous membrane is covered with a grayish pseudo-membrane that strips off with difficulty, taking with it all structures down to the very much thickened submucosa. Mesenteric glands: Moderately swollen and congested. Microscopically: Small intestine: Surface epithelium is partially denuded. The mucous membrane, excepting Peyer's patches, is apparently normal. Peyer's patches are moderately swollen, there being a moderate hyperplasia of the lymphoid cells only. No necrosis of cells. Submucosa and muscular is normal. Large intestine: Sections show a diffuse necrosis of the mucosa varying in intensity; in some places only the superficial edge is necrotic; in other places the necrosis extends through the entire depth and as far as the muscularis mucosæ. All the parts of the mucosa are affected, though the Lieberkühnian glands suffer especially. The blood-vessels are either injected or closed by means of pink thrombi. These thrombi show little or no fibrin and would appear to be made up of coalesced red blood corpuscles. The surface is not covered with a

definite membrane; the necrotic tissue adheres to the subjacent living tissues in general; occasionally it is lifted up and gives the impression of being a pseudo-membrane. At the line of junction of the living and dead tissues there is an invasion of the latter by polymorphonuclear cells, and there is a general increase of the cells in the mucosa. Nuclear fragmentation is not abundant. The solitary follicles show a somewhat more marked hyperplasia than in the small intestine, the centres showing endothelial proliferation. The mucosa is deficient over the follicles. The submucosa is œdematous and contains a greatly increased number of mononuclear cells, with eccentric nuclei, some of which are plasma cells. The muscular coat, except for the fibrous septa, which show an increased number of mononuclear cells, is normal. There is a massive bacterial development in the necrotic mucosa, and extension of bacteria a certain distance into the adjacent living mucosa. The bacteria consist of forms staining with Gram and decolorizing by Gram; among these are cocci and innumerable bacilli. The invading organisms also consist of cocci and bacilli, among which are forms having the colon-typhoid morphology. Cultures from this case gave colon bacilli from the peritoneum and all the organs, while, in addition, the bacillus dysenteriæ was obtained from the intestinal contents.

Case V.—G. C.; female; aged four months; admitted to the hospital December 24. Stools yellowish or greenish, two a day, no temperature till January 23; then trace of blood with gradual rise of temperature to 102.5°. Stools three to nine a day, contained mucus and blood. Death five days later. Bacillus of dysentery obtained by culture from the scrapings of the mucosa of the colon.

Autopsy.—Organs practically normal except liver, which was very fatty, and the intestines. Small intestine: Follicles in ileum prominent. Large intestine: In the cæcum and ascending colon a number of solitary follicles are seen, slightly elevated above the mucous membrane. The mucous membrane is moderately congested in irregular areas, but maintains its smooth, glistening appearance. In the sigmoid and rectum the solitary follicles are distinctly ulcerated, producing pock-marked depressions, and the neighboring mucous membrane is congested. The mesenteric glands are moderately enlarged. Microscopically: Large intestine: The general mucous membrane is normal excepting in the region of the solitary follicles, which are moderately

enlarged and over which the mucosa is deficient. There is no marked cellular reaction, and the hyperplasia of the follicles is a lymphoid one. Other coats normal. Small intestine: Shows a moderate hyperplasia of the follicles with enlarged endothelial centres. The submucosa and muscle are normal. Bacteria: Only a few bacilli negative to Gram were found on the surface, and of those positive to Gram a very occasional one.

Case VI.—C. C.; male; aged two years; had never been out of the institution. Three weeks before death the patient was found to be suffering from an acute nephritis. The urine contained twenty-five per cent. albumin, blood and casts; patient very œdematous. Impossible to find the cause of the nephritis, possibly a mild scarlatina that had been overlooked. Urinary condition did not change nor did the œdema. The patient had green, loose, watery stools till six days before death, then passed mucous stools; never any blood. Temperature at the end between 100° and 104°. The bacillus dysenteriæ was isolated three days ante mortem.

Autopsy.—Lungs: Œdematous. Liver: Fatty. Spleen: Congested. Ascites and anasarca. Kidneys: Enlarged, capsules free, small hemorrhages seen on the surface, cortex thickened and yellowish, pyramids prominent, consistence soft. Small intestine: Upper part congested, the lower 150 cm. is covered with a thick, almost continuous pseudomembrane, most marked toward the valve; on stripping it off, all of the mucous membrane is removed with it. There are hemorrhages beneath this membrane, which ends exactly at the ileo-cæcal valve. The whole wall of the intestine is very much thickened. Large intestine: Presents few small patches of congestion and the follicles are large. Mesenteric glands: Enlarged and red. Microscopically: Kidneys show marked degeneration of the epithelium; there are hemorrhages into the tubules, which contain casts. Within the capsules of the glomeruli there is an exudation of albumin, and there is beginning exudation into the kidney stroma. Ileum: The mucous membrane is almost completely necrotic; here there are remains of imperfectly preserved crypts. The necrotic mucous membrane is demarcated from the submucosa by a layer of cellular fragments, hemorrhage, and mononuclear and polymorphonuclear cells. At this level occasionally small vessels are thrombosed. The submucosa itself is swollen, infil-

trated with serum and fibrin, and shows here and there fragmented cells similar to those in the mucosa. The superficial muscular layer is infiltrated with small round cells. There is a massive development of bacteria in the necrotic tissue, but there is no definite false membrane. Colon: Shows congestion and hyperplasia of the follicles. There are scattered areas of very superficial and slight necrosis; no ulceration, and between these areas the gut is fairly normal. Bacteria: The surface and to a considerable extent the whole of the mucous membrane, but especially the remains of the glands, are closely packed with bacilli negative to Gram, which are scattered diffusely throughout and also collected in large masses.

Case VII.—J. M.; female. The child was two years old and an imbecile. She was taken sick in the latter part of November with diarrhœa.

November 28 no Shiga bacilli were found, but they were present on December 1. The patient had diarrhœa for one month, and then recovered from this completely, but ran down constantly and developed a very marked broncho-pneumonia, to which she succumbed on January 29. For several weeks before her death her stools had been brown and normal, and examination failed to show the presence of any dysentery organisms.

Autopsy.—There was very marked broncho-pneumonia with beginning abscess formation. The stomach, and small and large intestines, appeared normal but for congestion. No hemorrhages, no ulceration, no follicular swelling, and the mucous membrane had maintained its smooth, glistening appearance. Microscopically: Ileum: Slight congestion; no ulceration, no necrosis, moderate infiltration of the interglandular stroma with mononuclear cells, practically no polynuclear. This infiltration extended down to the submucosa, which was unaffected. Colon: Changes were the same as in the ileum. The cellular infiltration was a little more marked. Almost all the cells lining the crypts had been transformed into "goblet" cells. The solitary follicles were unaffected. Bacteria: Very few of any kind were found, and those were extremely superficial.

Case VIII.—G. F.; male; aged one year; admitted to the hospital suffering from diarrhœa, which he had had for some days. Death nineteen days later. Temperature the first few days 100° to

101°, rising again just before death. Stools two to five a day, green or brown and watery, with flakes of mucus; never any blood. Bacillus dysenteriæ found two weeks before death and again at autopsy.

Autopsy.—Lungs: Hypostatic pneumonia. Liver: Very fatty. Spleen: Showed microscopically endothelial increase in the follicles. Pancreas and kidneys: Negative. Small intestine: Minute superficial erosion of solitary follicles, and Peyer's patches. Large intestine: Same condition of follicles in the colon; no ulceration. Microscopically: Ileum: The follicles were hyperplastic, and there was very superficial ulceration over them with consequent depressions. Large intestine: The general mucosa, except in the neighborhood of the follicles, appeared normal. The follicles themselves were considerably enlarged, the enlargement being due chiefly to an increase in the endothelial elements occurring both in the centre of the follicles and in the periphery. The neighboring mucosa was infiltrated with endothelial cells, and there was a central depression which extended into the follicle, at which point the epithelium was deficient. The submucosa and occasionally just beneath this the muscularis showed a distinct cellular infiltration, the cells being of the mononuclear variety. Muscle normal. Bacteria: Bacilli negative to Gram were found in considerable number extending quite deeply in apparently healthy tissue toward the submucosa.

Case IX.—S. T.; female; aged one year. In January the patient had bronchitis. Illness began on February 7 with broncho-pneumonia. Five days later, up to this time having been constipated, she developed diarrhœa, with blood and mucus in the stools, which were four to five a day. The temperature was falling till the intestinal symptoms developed, then it rose, and remained continuously high, 101° to 103°, till death, six days later. Two days after admission the stools were examined and were negative; five days before death, that is, one day after the diarrhœa developed, the examination was positive for Shiga bacilli.

Autopsy.—Lungs: There was broncho-pneumonia. All other organs negative but the colon, the mucous membrane of the lower two-thirds of which was much thickened, appearing œdematous and congested. Microscopically: The mucous membrane of the colon was in general well preserved. There was a transformation of many of the cells in the crypts into goblet cells, and some of these crypts were dilated so as to be

three or four times as large in diameter as the normal ones. Slight general congestion was present. The follicles were moderately enlarged, due to a proliferation of endothelial cells. No ulceration and no infiltration of the coats with cells. The submucosa and muscularis were normal. Bacteria: Organisms positive and negative to Gram infiltrated the mucous membrane to no very great depth and in small numbers.

Case X.—R. W.; male; aged three years; admitted December 31. Death, February 21. Diarrhœa all the time; stools watery and foul until three weeks before death, then they began to contain blood and mucus. Temperature, occasionally 101° to 103°, promptly coming down again. The bacillus dysenteriæ was isolated three weeks and again two weeks before death.

Autopsy.—Lungs: Marked broncho-pneumonia. Liver: Large and fatty. Stomach: Congested throughout. Small intestine: Congested and follicles prominent throughout. Large intestine: Markedly congested, with rough, granular appearance and superficial ulcerations. Microscopically: Ileum: Mucous membrane was congested and the lymphoid tissue was hyperplastic. Large intestine: The mucous membrane was in places greatly modified. In these parts the glandular structures were invisible. The mucous membrane consisted of small cells and remains of crypts which were much compressed. On the surface there was a necrotic pseudo-membrane consisting of filaments of fibrin and desquamating cells which were necrotic. The submucosa and muscularis appeared quite normal. An additional section of this part showed in addition to the pseudo-membrane a fair number of polymorphonuclear cells and cellular fragments. Bacteria: In the pseudo-membrane there were many organisms, chiefly cocci positive and bacilli negative to Gram's stain, the latter predominating, but they did not invade the tissues to any great depth.

Case XI.—H. S.; male; aged one year; admitted to the hospital March 1. He had been in the hospital a month before suffering from diarrhœa and anæmia, but had been discharged in good condition. His temperature on admission was 102°, and this dropped to normal for one day, but rose again irregularly to 104° till death, six days later. His stools were three to four a day, green, with mucus and occasionally blood. There were marked meningeal symptoms. The organism of dysentery was cultivated from the stools five days before death.

Autopsy.—Lungs: Congested. Spleen: Congested. Liver: Extremely fatty. Stomach: Normal. Brain: Negative. Small intestine: Peyer's patches, and solitary follicles a little enlarged and presented "shaven-beard" appearance. Large intestine: Congested, especially at lower end, and the follicles were prominent. Microscopically: Small intestine: The ileum was in an excellent state of preservation. Large intestine: There was congestion of the mucosa. Almost all the epithelial cells of the crypts were in the state of "goblet" cells. The lymphoid tissue of the solitary follicles was hyperplastic. The submucosa and muscularis were normal. The mesenteric glands were congested. Bacteria: Sections stained for organisms showed practically no organisms positive to Gram; negative to Gram there were a moderate number superficially situated, and of these a few were of the colon size and form.

Case XII.—M. M.; female; aged ten and one-half months. The patient had been very ill for one month with nasal diphtheria, double otitis, and cervical adenitis. Eight days before death she had a chill and rise of temperature followed by pulmonary signs. Temperature went up to 104° and stayed till just before death, when it dropped rapidly. Seven days before death mucus appeared in the stools, never any blood. Culture from scrapings of the mucosa of the colon showed a growth of the bacillus dysenteriæ (Shiga).

Autopsy.—Lungs: Marked pneumonia of right lung with empyema. Liver: Fatty. Spleen: Large and soft. Stomach: Post-mortem digestion. Small intestine: Negative. Large intestine: No ulceration, no congestion. Mesenteric glands: Enlarged. Microscopically: Ileum: Normal. Colon: The mucous membrane throughout was practically normal. There was no congestion, and no infiltration with cells. The submucosa and muscular layers were normal. The follicles were intact and not hyperplastic. Spleen: Very marked proliferation of the endothelial centres of the Malpighian corpuscles. Bacteria: Very superficial and few in number.

Case XIII.—J. W.; male; aged two months; admitted to hospital March 25, with pneumonia. Died April 3. He had one to three yellow and green stools a day; no mucus and no blood. Temperature before death for two days, 98° to 100°. Five days before death no Shiga bacilli; two days before death the bacilli were isolated.

Autopsy.—Lungs: Typical and very marked broncho-pneumonia. Spleen: Large, dark, red, and soft. Liver and Kidneys: Degenerated. Stomach: Normal. Small intestine: There were congested Peyer's patches, and the solitary follicles were pigmented and showed typical "shaven-beard" appearance most marked low down. Large intestine: Was slightly congested, and the follicles prominent. Microscopically: Ileum: The solitary follicles and Peyer's patches were a little enlarged from an increase of the lymphoid cells; except for this the appearance was normal. Large intestine: The mucous membrane was in an excellent condition of preservation. The follicles were slightly swollen, no other changes. Spleen: Was much congested, with hyperplasia of the pulp. Bacteria: These were very few and very superficial.

Case XIV.—M. T.; male; aged eighteen months. An enormously rachitic child, with bronchitis and beginning pneumonia. Was admitted March 11, and died March 17. Constipated most of the time till two days before death, when the stools became merely mucus with blood, and the bacillus of dysentery was found.

Autopsy.—Lungs: There was beginning broncho-pneumonia. Small intestine: Congestion in the lower half of the ileum, with the solitary follicles and Peyer's patches slightly enlarged. Large intestine: Intense congestion of the mucous membrane of the entire colon; no ulcers. Microscopically: Small intestine: The agminated follicles were much swollen, the centres converted into large germinal centres with many endothelioid cells, and in the periphery the endothelial cells were also increased. The mucosa was complete over these swollen follicles. Submucosa and muscle appeared normal. Large intestine: In all of the crypts were numerous "goblet" cells. Distinct hemorrhages had taken place in the mucosa. In the neighborhood of one of these hemorrhages was an area of necrosis that extended to the submucosa. Where this occurred, the staining of the cells was absent and the tissues were disintegrated. A large number of bacteria were seen in this area, but no reaction was present. The submucosa was intact. Bacteria both positive and negative to Gram's stain were present on the surface, but in the necrotic areas they were found in countless numbers.

Case XV.—A. C.; female; was admitted to the hospital after a pneumonia, with râles the only sign in the chest. The patient had diarrhœa, with two to four stools a day, green, with mucus, but never any

blood. The temperature never rose above 100°. Two days before death the bacillus dysenteriæ (Shiga) was obtained from the stools.

Autopsy.—Liver and Kidneys: Degenerated. Spleen: Congested. Other organs, including stomach, normal. Small intestine: Solitary follicles and Peyer's patches were a little swollen and appeared slightly ulcerated; lower two inches of ileum were congested, and changes there were more marked. Large intestine: All the follicles were prominent, and many, especially in lower portion, were dimpled. The whole wall in lower six inches was much thickened, and the mucous membrane was pale, rough, and granular, and looked necrotic. Mesenteric glands: Enlarged. Microscopically: Small intestine: There was denudation of the surface epithelium and much breaking up of the mucous layer. The agminated nodules were swollen—the swelling consisting in a moderate lymphoid hyperplasia without necrosis. The general mucous membrane was normal in appearance. The submucosa was moderately infiltrated with mononuclear cells, some of them having eccentric nuclei. Large intestine: The mucous membrane was thin, with great deficiency in the crypts of Lieberkühn. The solitary nodules were prominent but not markedly enlarged. The superficial mucosa in many places refused to stain, and in others the staining was absent or poor below the muscularis. Fragments of nuclei were occasionally seen in the non-staining portion, but there was a striking absence of leucocytic reaction in the adjacent living tissue. In the submucosa there was cellular infiltration similar to but more intense than that in the small intestine. Spleen: Congested, and the germinal centres of the Malpighian bodies showed endothelial hyperplasia. Bacteria: A moderate number of Gram positive organisms were found. The Gram negative bacilli of colon morphology extended deeply into the tissues. The necrotic areas were closely packed with them, and even the submucosa contained a decided number in its more superficial part, especially around the blood-vessels.

Case XVI.—R. B.; male; aged thirteen weeks; admitted at five weeks old for malnutrition. The patient had gonorrhœal ophthalmia and gonorrhœal joints. Never any mucus or blood in stools, and always a subnormal temperature. Stools two to six a day, thin, yellow or green. The dysentery bacillus was found two weeks before death.

Autopsy.—Lungs: There was beginning broncho-pneumonia. Stomach, duodenum and jejunum normal. Ileum: Peyer's patches pig-

mented, otherwise not affected. Large intestine: The upper half congested. The mesenteric glands not enlarged. Liver: Congested. Spleen: Firm and hard. Microscopically: Small intestine: No changes. Large intestine: Slight congestion, otherwise all the coats were in an excellent state of preservation. Spleen and liver showed congestion. Bacteria: Very few of any kind, and they were superficially situated.

Case XVII.—J. K.; male; aged three and one-half months; admitted to the hospital suffering from malnutrition and indigestion. The patient did fairly, and gained a little for a time; then began to have frequent stools, about five a day; eight days before death these contained mucus, never any blood. Temperature for eight days of disease 101° to 103°. Bacillus dysenteriæ (Shiga) found eight days before death.

Autopsy.—Spleen: Congested and enlarged. Lungs: Hypostatic pneumonia. Stomach: Normal. Small intestine: Congested with swelling of Peyer's patches. Large intestine: Intense congestion throughout; no ulcerations made out; follicles swollen. Microscopically: Ileum: Surface columnar epithelium mostly denuded. Mucosa, excepting lymphoid structures, appeared normal. Agminated nodules were swollen and there was a general hyperplasia of lymphoid cells and a marked proliferation of endothelial cells of the germinal centres. All other structures were normal. Large intestine: The changes were similar to those in the small intestine; no ulceration. Spleen: Much congested. Bacteria: Very few of any kind were found.

Case XVIII.—A. H.; male; aged seven months and nine days; brought to the hospital with a history of three days' diarrhœa. Child very fat, but very rachitic. Died on the twelfth day of the disease. Stools three to seven a day, green, with much mucus, never any blood. Temperature irregular, 99° to 102°, rising just before death. Was given 10 c.c. of "Harris" serum, with temporary improvement but no lasting benefit. The Shiga bacillus was isolated from the stools ante mortem.

Autopsy.—Adipose: Abundant. Lungs: Lower lobes congested. Liver: Large and fatty. Stomach, duodenum and jejunum normal. Ileum: Congested irregularly in the lower eighteen inches. Large intestine: Congested in patches throughout its whole extent, and had lost to a slight degree its smooth appearance. The mesenteric glands were not enlarged. Microscopically: The lymphoid tissue of the lower

ileum and colon was slightly hyperplastic. Except for this there were no marked histological changes. Bacteria: A few cocci and bacilli were found in the superficial mucosa.

Case XIX.—B. F.; male; aged nine months and twenty-seven days; brought to the hospital in bad condition, with diarrhœa and without any accurate previous history. The patient was very emaciated, had meningeal symptoms, stiff neck, irregular pupils and internal strabismus. Stools most of the time were yellow, occasionally green, with a trace of blood, two to five a day. The temperature, at first below 100°, rose irregularly till death at 104°. The bacillus of dysentery was isolated three days before death. Length of illness in hospital fourteen days.

Autopsy.—A very much emaciated child. Lungs: Œdematous. Brain: Negative. Liver: Very fatty. Stomach: Normal. Small intestine: Upper part normal. In the lower two feet the Peyer's patches were enlarged, with small superficial ulcerations over them, and the mucous membrane appeared a little thickened. Large intestine: There was congestion, most marked in the neighborhood of the ileo-cæcal valve. The solitary follicles were dimpled. The changes were slight in the descending colon and sigmoid. The mesenteric glands were slightly enlarged. Microscopically: Small intestine: General mucosa presented little alteration. As the confines of the swollen lymphoid nodules were approached, the villi were swollen and rendered more obtuse by an increase of the lymphoid cells. The lymphoid masses were markedly enlarged, the new cells being of the lymphoid habitus. From the centre of the mass there was a funnel-shaped depression in which the lymphoid cells often stained poorly and over which the mucosa was imperfect. The submucosa and muscle presented no striking alteration. Colon: The mucous membrane of the large intestine was not very much changed, but the solitary nodules were enlarged in a manner similar to that described in the small intestine, and over them the epithelial layer was deficient. Bacteria of any form or staining properties were few in number.

Case XX.—R. A.; male; aged nine months and twenty-six days. The patient was brought to the hospital in poor condition with Bednar's aphthæ. There were bad stools, three to six a day, very foul, green, with mucus, and occasionally a little blood. Irregular, mod-

erate temperature. The patient failed gradually and died marantic after two and a half weeks in the hospital. The Shiga bacillus was obtained at autopsy by scraping the mucous membrane.

Autopsy.—The body was much emaciated. Lungs: Tubercles scattered throughout both lungs. Bronchial glands: Cheesy. Liver: Fatty. Spleen: Small and soft, presenting tubercles on surface and on section. Stomach, duodenum, and jejunum negative. Ileum: Lower foot congested. In the lower two inches the Peyer's patches were reddened and swollen. Large intestine: Upper one-eighth of colon irregularly congested. Lower seven-eighths much congested, and a yellow stringy material was irregularly distributed over and adherent to it. Follicles apparently not affected. Mesenteric glands: Slightly swollen and reddened. Microscopically: Large intestine: The mucosa was thickened, the thickening being due to cellular products on the surface of the mucosa. These cells were desquamated epithelium and other surface cellular elements which covered the crypts to a considerable depth. The crypts themselves were of quite normal appearance. The submucosa and muscle were normal. The solitary follicles were swollen, but not remarkably so. Small intestine: There was a similar desquamative condition of the surface cells, and in addition a moderate enlargement of the agminated follicles due to an increase of lymphoid cells. No changes in the submucosa. Bacteria: Chiefly bacilli negative to Gram were found in the superficial portion of the mucosa in small numbers, and in rather greater numbers among the desquamated epithelial cells.

Case XXI.—J. S.; female; aged seven months and twenty-four days; a well-nourished child, began to be ill acutely, with temperature 103°, rising in twenty-four hours to 104.5°. Stools at first brown and loose, two to four a day. The temperature then dropped to normal, and after three days the stools were normal for twenty-four hours. Following this a rise of temperature to 103°, and stools became frequent and green, with mucus and blood. Death five days later despite the injection of 10 c.c. of "Harris" and 10 c.c. of "Seward" serum. Temperature for the last three days, 100° to 102°. The Shiga organism was isolated from the stools five days before death, and was also found post-mortem from the scrapings of the mucous membrane of the colon.

Autopsy.—Lungs: Slight congestion of the lower lobes. Liver:

Fatty. Spleen: Small and firm. Stomach: Normal. Small intestine: Lower six inches slightly congested. Large intestine: Congested, and in places there were small hemorrhages into the mucosa. The mucous membrane, especially near the ileo-cæcal valve, presented very small superficial yellowish areas of apparent necrosis. Microscopically: Small intestine: Practically normal. Large intestine: Throughout its whole extent there was congestion; in the sections from the neighborhood of the ileo-cæcal valve the blood-vessels of the mucosa and submucosa were enormously dilated; in the former situation there were actual hemorrhages. There were small areas near the hemorrhages whose cells stained poorly, and there was actual although superficial loss of substance. There was considerable inflammatory reaction around these areas. The submucosa was much infiltrated with mononuclear cells, especially in the superficial portion. The muscularis was normal. In other parts of the colon the changes were less marked. Bacteria: Cocci and bacilli positive and negative to Gram were found in great numbers in the neighborhood of the necrotic portions. No especial type seemed to predominate.

Case XXII.—M. B.; female; aged eleven months and twenty-six days. While in the institution suffering from measles she had had a diarrhœa with numerous green mucous stools; no blood. The bacillus of dysentery (Shiga) was then isolated from the stools. Two weeks later the patient developed diphtheria of the pharynx and larynx with consecutive broncho-pneumonia. Death took place one week after the first signs of diphtheria.

Autopsy.—Tonsils, pharynx, epiglottis, larynx and vocal cords covered by a greenish-brown false membrane. Lungs: Left lower lobe was consolidated, with hemorrhages into the pleura. Liver: Very fatty. Spleen: Large and soft. Stomach, duodenum and jejunum normal. Ileum: Peyer's patches in the lower portion were reddened, and covered with a small amount of adherent yellowish material. Remainder normal. Large intestine: The congested mucous membrane was thickened in spots with small ulcerations. The follicles had superficial erosions, especially in the sigmoid. Microscopically: Large intestine: The general mucosa appeared normal. The follicles were enlarged, the hypertrophy being due chiefly to lymphoid-cell increase, and the adjacent submucosa was infiltrated with small cells. In the neighborhood of the

follicles, but more or less independent of them, were ulcers of small diameter that extended often to the submucous coat. Covering these ulcers and the adjacent surface of the submucosa was a fibrinous cellular exudate which was closely adherent. The submucosa in the neighborhood of the ulcers, and even at a distance, contained a strong mononuclear infiltration. The other coats were normal. Small intestine: Presented a marked hypertrophy of the follicles, with a similar fibrino-cellular covering upon the adjacent mucous membrane. The general submucosa was less invaded than in the large intestine. Bacteria: Staining for these demonstrated but few.

Case XXIII.—M. K.; male; aged five months and twenty-two days; returned to hospital with a history of diarrhœa and with general malnutrition. Twelve days in the hospital. Temperature 99° to 100°. Stools four to five a day, green, with mucus. Blood first appeared one week before death, and the last day was very abundant. The Shiga bacillus was isolated ten days before death.

Autopsy.—A small, poorly nourished infant. Beginning broncho-pneumonia. Liver: Fatty. Spleen: Small and firm. Stomach: Normal. Duodenum and jejunum normal. Ileum: Small areas of congestion; no ulceration or involvement of the lymphoid tissue. Large intestine: Slight irregular congestion. Few prominent follicles. Microscopically: Except for a moderate congestion, there were no histological changes in the small or large intestine. Bacteria of any description were very scanty.

Case XXIV.—H. L.; male; aged one year and four months; brought to the hospital with signs of pneumonia over left lower lobe, which constantly extended, and with temperature of 104°. Very ill from the beginning, and had five to eight stools a day, green, with mucus; never any blood. Temperature dropped after six days to 99°, but rose again to 102° and 103°, and remained there till death, twenty-one days later. The bacillus dysenteriæ was obtained by scraping the mucosa post mortem.

Autopsy.—Lungs: Broncho-pneumonia scattered through both lungs. Bronchial glands: A little enlarged; no signs of tubercle. Liver: Large, soft and pale. Spleen: Large and soft. Kidneys: Soft and pale. Stomach: Negative. Duodenum and jejunum normal. Ileum: Peyer's patches were swollen and congested. Large intestine was con-

gested throughout with some loss of its normal, smooth, velvety appearance, and this was most marked low down and in the region of the ileo-cæcal valve. Follicles not prominent. Mesenteric glands: Much enlarged and caseous; tubercle bacilli demonstrated by staining. No other tuberculous lesions found. Microscopically: Small intestine: Congestion and moderate hyperplasia of the agminated follicles. Large intestine: The mucous membrane in general was in an excellent state of preservation. There was a transformation of many of the cells in the crypts into "goblet" cells, with subsequent dilatation of the crypts to four or five times their normal diameter. The other coats were normal. Bacteria: Very few of any kind were seen, and these were very superficially situated.

Case XXV.—C. C.; male; aged eight months and twenty-two days; a poorly nourished child, with indefinite signs in the chest. The patient was admitted to the hospital with diarrhœa, which persisted till death, twenty-eight days after. The stools, four or five a day, were green and yellow, with mucus; occasionally a trace of blood. Temperature, 98° to 100°. Failed rapidly. Shiga bacillus was isolated seven days before death.

Autopsy.—Lungs: On the visceral pleura were fresh tubercles; the parietal pleura normal. The left apex contained numerous caseous, tuberculous masses, together with small, fresh tubercles. Bronchial glands: Enlarged and cheesy. Liver: fatty. Spleen: Contained small, fresh tubercles. Stomach: Normal. Duodenum and jejunum normal. Ileum: Peyer's patches were enlarged and ulcerated, the edges of the ulcers thickened, and they extended deeply into the muscular coat. They were round, not longitudinal or perpendicular to the long axis of the gut. While their general appearance was tuberculous, no tubercles were seen on the peritoneal coat. Large intestine: All the solitary follicles appeared enlarged, and the edges of many were congested. The majority were slightly pitted. The mesenteric glands were enlarged and caseous. Microscopically: There were tuberculous processes in both the small and large intestine which so obscured the other lesions that it was not considered advisable to draw any conclusion from this case.

Case XXVI.—V. M.; male; aged six months and nineteen days; a poorly nourished child, was admitted to the hospital with a history

of several days' diarrhœa. The patient was under observation five weeks, with practically a normal temperature, rising occasionally to 102°. The stools were fluid and green, two to five a day; no blood; slight amount of mucus. The bacillus of dysentery was isolated from the stools on the day of admission.

Autopsy.—Liver: Large and soft. Spleen: Hard and small. Small intestine: Peyer's patches congested; no ulceration. Large intestine: The mucous membrane near the ileo-cæcal valve was congested; throughout the rest of the colon the follicles were pigmented and slightly depressed. Microscopically: Owing to the length of time of the autopsy after death, post-mortem changes had taken place in the intestine that made them unsuitable for microscopical examination.

Case XXVII.—C. C.; male; aged seven months. A history of two days' diarrhœa before admission to the hospital. The stools were green, with mucus, two to six a day. No blood appeared till two days before death, after an illness of thirty-four days. Temperature, 98° to 101° until just before death, then a rapid rise to 104°, followed by a fall. Shiga bacillus was not found twenty-eight days before death; examination positive eighteen days before death.

Autopsy.—The child was much emaciated. Liver: Fatty. Spleen: Firm and dark. Stomach: Normal. Small intestine: Appeared normal, except the last two inches of the ileum, which were greatly congested. One small spot the size of a pea was thickened, exfoliating, and covered with a necrotic mass. Large intestine was very much thickened throughout its whole extent, apparently due to a swelling of the submucosa. There was congestion throughout. In places extending for two or three inches, there were hemorrhages into the mucosa. In no place did the mucous membrane appear smooth, but rough. No ulceration was made out, no follicular enlargement. The mesenteric glands were a little enlarged. Microscopically: Lower ileum was greatly modified at one point. The structure of the mucosa was almost obliterated on account of great swelling of the villi and the greatly diminished staining power of the cells. In places, however, the crypts were fairly preserved. There was much congestion, and definite hemorrhage into the tissues. Overlying the mucosa and attached to it in a definite locality was a necrotic pseudo-membranous mass containing fibrin and desquamated and emigrated cells. The muscularis mucosæ was preserved practically

intact, but the submucosa was swollen, infiltrated with serum and mononuclear cells, the blood-vessels being injected. The muscular coat appeared normal, as did the peritoneum. Colon: The mucosa was fairly normal, although there were hemorrhages into it, at which points the staining of the cells was very imperfect. The hemorrhages extended into the submucosa, which was swollen, containing an excess of mononuclear cells, though it was much less affected than the submucosa of the small intestine described. Bacteria: There was a massive bacterial growth in the pseudo-membranous mass, as well as in the mucosa of the lower ileum and colon. Organisms: cocci and bacilli were found in great numbers, but the bacilli of the colon habitus and staining qualities predominated especially in the mucous membrane, where they extended as far as the muscularis mucosæ, but no deeper.

Case XXVIII.—M. H.; female. The patient was ill ten days with diarrhœa. Stools one to seven a day, green and fluid, with mucus. No blood. Temperature, 98° to 102°, only reaching this latter figure once. The child failed rapidly and died marantic. Bacillus dysenteriæ (Shiga) was isolated from the stools three days before death.

Autopsy.—Liver: Fatty. Spleen: Small, soft, atrophic. Stomach: Negative. Small intestine: Negative, except for "shaven-beard" appearance. Large intestine: Follicles a little prominent and pigmented. No ulceration. Mesenteric glands: Not enlarged. Microscopically: Ileum and colon presented no marked histological changes. Bacteria: Practically absent.

Case XXIX.—L. U.; aged eight months and eight days; a very poorly nourished child, was admitted to the hospital in a moribund condition, with a normal temperature, but with green fluid stools containing mucus and blood. Death occurred two days later. Four to five stools a day. Temperature 104° at death. The bacillus of dysentery was isolated the day before death.

Autopsy.—An emaciated child. Liver: Very fatty. Spleen: Atrophy of pulp. Stomach, duodenum, and jejunum normal. Ileum: The Peyer's patches were pigmented, otherwise normal. Large intestine: The mucous membrane appeared normal. A few follicles near the ileocæcal valve were prominent. Microscopically: The mucous membrane of ileum and colon, as in fact all the coats, was quite normal. In

the colon there was slight hyperplasia of the lymphatic tissue. Bacteria: There were very few organisms of any kind discernible and these were most superficial.

Case XXX.—M. W.; female; aged four months and six days; a fairly nourished child, with a history of four days' diarrhœa, was admitted to the hospital in a condition of extreme prostration. The stools were frequent and green, with a slight amount of mucus, and just ante mortem a trace of blood. The patient had very slight temperature, varying from 98° to 100°. She took nourishment badly, refused food and vomited what she did take. Death occurred three days later. The bacillus dysenteriæ (Shiga) was obtained by scraping the intestinal mucosa post mortem.

Autopsy.—Liver: Soft and fatty. Spleen: Normal. Stomach, duodenum, jejunum, and ileum normal. Large intestine: Congested throughout, but more intensely in cæcum and sigmoid. No ulcerations. Follicles not affected. Microscopically: Ileum: Normal. Large intestine: The mucosa was congested, the blood-vessels widely dilated with blood but no hemorrhages, and except for this, a quite normal histological appearance.

Case XXXI.—J. R.; male; aged fifteen months. The patient had suffered for several months from malnutrition and vomiting. Admitted at the age of ten months. Weight, seven pounds and fifteen ounces. Improved slowly, and one month later was taking food well and gaining in weight. Then vomiting and loss of weight followed, though the stools were normal. Three months after admission the stools became loose, four to six a day, containing no blood, but later a little mucus and undigested food. This condition persisted for a long time, and twenty-nine days after the beginning of the diarrhœa the bacillus dysenteriæ (Shiga) was obtained from the stools. Two days later the bacillus was no longer found, and at the autopsy three weeks later it could not be recovered by scraping the mucous membrane of the colon. The child failed constantly, and died in a condition of extreme marasmus, weighing but six pounds and four ounces.

Autopsy.—Lungs: Congested. Liver: Small and dark. Spleen: Dark red, follicles prominent. Stomach and duodenum normal. Jejunum: Contained two small ulcers. Ileum: Peyer's patches slightly swollen, and a few small ulcers were present in them. Colon: Here

were many ulcers extending through the mucosa and even down to the muscular coat, but the peritoneal surface was quite smooth everywhere. The ulcers were irregularly oval or round, with raised edges, and were not limited to the solitary follicles, which were not enlarged. Microscopically: Small intestine: The ulcers were relatively superficial and involved the layer of the crypts but did not extend through the mucosa. The base consisted of granulation tissue diffusely spread out, extending beyond the limits of the ulcer and invading the adjacent mucous membrane, the crypts of which were widely separated, and also invading at a distance the submucosa. The muscular coat escaped. Large intestine: The chief lesion was an ulcerative one affecting the mucous membrane and to a marked extent the submucosa. The ulcers were clean, the base of them consisting of granulation tissue in a state of advanced formation. The superficial edge of the ulcers presented a reticulated appearance, due to a superficial necrosis of the granulation tissue, in which fibrin and degenerated mononuclear cells were contained. Where the glands were retained, many had become dilated so as to form small cysts. The spleen is interesting, as it showed a marked endothelial transformation of the germinal centres of the Malpighian bodies. Bacteria: Very few cocci and bacilli found on the surface of the ulcers as well as in the mucous membrane.

Case XXXII.—R. M.; male; aged five months. The patient was nursed for one month, and since then fed on diluted cow's milk. For eight days had vomiting and diarrhœa. Slight irregular temperature. The child was in the hospital six days with constant diarrhœa, stools green or yellowish and watery, occasionally mucus; no blood. Died very much emaciated. The bacillus of Shiga was isolated from the stools five days before death, and again at autopsy from scrapings from the colon.

Autopsy.—An emaciated child. Liver: Moderately fatty. Spleen: Small, dark, and firm. Stomach: Normal. Small intestine: Many small ulcers, extending through the mucosa only and not limited to the solitary follicles. These were present in the duodenum, jejunum, and ileum. Almost all the Peyer's patches were swollen and contained several small ulcers. No deep ones. Large intestine: The solitary follicles were a little enlarged; no ulceration. Mesenteric glands: Slightly swollen and gray. Microscopically: Small intestine: There was a gen-

eral hyperplasia of Peyer's patches, the enlargement being due partly to an increase of lymphoid cells and partly to endothelial transformation of the germinal centres. There was an increase in lymphoid cells, in the mucosa in the neighborhood of these large follicles. The ulcer examined microscopically within a Peyer's patch extended about halfway through the mucous membrane though the cells of the patch were degenerated throughout. The surface of the ulcer was covered by a fibrinous and cellular exudate, and the vessels within that portion of the mucosa were thrombosed. In the submucosa there was an infiltration of the lymphoid-cell type. Large intestine: A "goblet-" cell transformation of the epithelium. Spleen: Germinal centres presented an endothelioid transformation. Bacteria: Only a few, and those superficially situated.

From a study of these tabulated cases it seems that they fall with considerable accuracy into several different groups according to the histological findings. Group A, comprising Cases *IV*, *VI*, *X*, *XXII*, and *XXVII*, represents the most severe changes met with, which are more like those found by Flexner and Strong in the adult dysenteries of Manila than any I have to report. In these cases the change is a pseudo-membranous one, though the membrane is by no means continuous, but of irregular distribution in Cases *X*, *XXII*, and *XXVII*; in Cases *IV* and *VI*, however, it is very extensive, in *IV* in the colon and in *VI* in the ileum. This pseudo-membrane is composed chiefly of necrotic tissue, desquamated cells, and countless bacteria. Fibrin plays in it a very small part, two of the cases, and those the most intense, *IV* and *VI*, having none at all. There is necrosis of the mucosa in all these cases, and it is this which chiefly gives the appearance of a false membrane, but the necrosis does not extend beyond this coat. In this necrotic tissue and at its border there are hemorrhages and thromboses, and it is divided from the healthy tissue by a zone of mononuclear and polynuclear cell infiltration.

The submucosa in four of the cases of this group is much affected—it is swollen both from œdema and from cellular infiltration. This infiltration is composed of mononuclear cells, many with the eccentric nuclei characteristic of Unna's plasma cells, and is found most marked about the blood-vessels. The submucosa in the fifth case is unaffected. The muscular coat is spared except for a slight mononuclear cell in-

filtration along the fibrous septa in one case, and the peritoneal coat is normal save in the case of peritonitis.

It is interesting to note in this connection that though such cases in adults run, as a rule, very acute courses, one of these children lived eighteen and two twenty-one days after the bacillus was isolated from the stools, while the other patients survived only six and eight days after the stools contained mucus or blood.

Two cases, *VI* and *XXII*, were so-called "terminal infections," occurring in nephritis and measles respectively, the latter being also complicated by diphtheria.

In Group B, comprising Cases *I*, *V*, *VIII*, and *XIX*, we find a different picture. Here the mucous membrane in both small and large intestines is in general in a good state of preservation; it is the lymphoid elements that suffer. In three cases both small and large intestines are involved in the process, in the fourth only the colon. The change consists in a hyperplasia of the lymph follicles both agminated and solitary, and this hyperplasia is lymphoid in three of the cases and endothelioid in the fourth. The elements of these follicles show a tendency to invade the surrounding tissue. Over these follicles there is a deficiency of the epithelium and more or less excavation of the follicles themselves, causing the well-known "dimpling."

The submucosa was in all cases approximately normal, nor did the muscular or peritoneal coats appear changed.

The case of Park and Carey,[10] the only autopsy in an infant suffering from undoubted Shiga infection that I have been able to find reported up to this time, evidently belongs to this group, the lesions being chiefly in the solitary follicles.

Of this group three of the cases were known to have been ill for fourteen days or over, and the fourth had diarrhœa for only five days, but before this his stools were green and rather numerous and had not been examined, so that it is possible that the bacillus was present for a longer time. These changes are what one would expect in subacute cases with a more delayed termination, and, as mentioned above, this is true of three of the cases at least, and possibly of the fourth. Case I was a terminal infection secondary to a broncho-pneumonia; the other three were primary cases.

Group C includes those cases characterized by superficial necrosis

and ulceration in the mucous membrane not limited to the follicles, as in Group B, and not accompanied by the formation of a pseudo-membrane, as in Group A. Of this group there are five examples, *viz.*, XIV, XV, XX, XXI, XXXII.

The changes in these cases consist in congestion and hemorrhage into the mucosa, with necrosis of isolated portions of the mucous membrane, which necrotic portion may be exfoliated so as to form ulcerations on the surface. The necrotic area and ulcerations are usually surrounded by a zone of inflammatory reaction. The lymphatic tissue participates more or less in the process. The submucosa escapes with the exception of one case, where it shows a cellular infiltration. The other coats are unaffected.

Two of these cases were very acute, lasting but two and eight days respectively, while the others ran a course of about two weeks.

Cases XIV and XV were terminal infections secondary to pneumonia.

The Group D, embracing those cases that present microscopically but few discoverable lesions, is a large one—Cases II, III, IX, XI, XII, XIII, XVI, XVII, XVIII, XXIII, XXIV, XXVIII, XXIX, and XXX. Several facts may contribute to account for this. I have not considered the loss of the superficial epithelium as a pathological lesion, and have only regarded loss of substance as true and not an artifact when it has been surrounded by a definite reactionary zone. The autopsies in most of the cases, unfortunately could not be obtained immediately after death, as they should be to draw any conclusions from the condition of the superficial epithelium, and loss of substance occurs so easily that in order not to arrive at any false conclusions this plan was adopted. It is possible that autopsies obtained a few minutes after death will allow of some deductions in regard to the epithelial coating.

Then, too, the microscope fails to help us very much in the vascular changes in the mucosa on account of the various procedures to which the tissue has to be subjected in the course of hardening, and for this reason the macroscopic examination probably gives us a truer conception of the amount of congestion.

And, lastly, five cases of this group were terminal infections occurring in children suffering from serious and even fatal diseases, and others were almost entirely in badly nourished institutional infants to

whose marasmus the infection with the Shiga bacillus was terminal. The infection was of a comparatively short duration, and their reaction undoubtedly poor. Beyond congestion, moderate hyperplasia of the lymphoid tissue, and in one case a little cellular infiltration of the superficial portion of the submucosa, there was very slight histological change.

Case XXXI presents lesions quite distinct from any of the others. The ulcerations were very deep and were in the process of repair, death being due to marasmus after all intestinal symptoms had ceased and the Shiga bacillus had disappeared from the stools, nor could it be found post mortem by scraping the mucosa.

Cases XXV and XXVI could not be classed with any of the groups owing to their unsatisfactory microscopical examinations, while Case VII is worthy of special mention though presenting practically no abnormal change on account of the fact that it was a case that had recovered completely from the infection to fall a victim later to pneumonia.

From the foregoing it will be noticed that the severe cases are decidedly in the minority. The lesions occur with the greatest frequency in the mucosa of the colon and the lower few inches of the ileum, those in the colon being usually much more intense and extensive. The pseudo-membrane in Case VI, however, is confined entirely to the small intestine, the ulcerations in Case XXXII are confined entirely to the small intestine, and Case XXVII, although only a little of the ileum was affected, had its most intense process there. Though the submucosa is at times affected, there is no considerable change in this unless the mucosa has suffered severely. Only in the most intense inflammations does the muscular coat participate in the process, and then very slightly, while the peritoneum escapes, the case with general peritonitis (IV) being an exception.

As far as the other organs are concerned, there were no characteristic findings. The mesenteric glands are usually somewhat enlarged, rarely markedly so, and grayish or pinkish. The lungs show hypostatic congestion and small areas of broncho-pneumonia, unless the Shiga infection is secondary to some more pronounced pulmonary lesion.

The liver is fatty in about the same percentage as in other infantile conditions. The spleen is, as a rule, unaffected, but when some other

infection is added presents the ordinary changes common in infectious diseases. Cloudy swelling is the rule in the kidneys.

In eight cases cultures were made from all the organs at autopsy, but in no case was the bacillus found except in the intestinal tract. The tubes from the organs when transplanted in small quantity, except the lungs, where many different organisms were found, either remained sterile or showed a growth of colon bacilli. In one case streptococci grew from the liver. This negative bacteriological finding is the characteristic one in adults, though cases of a general blood-infection are reported. The method advised by Flexner of plating considerable quantities of tissue, by which he was able to demonstrate the presence of bacilli in the liver and mesenteric glands, was not employed.

An examination for micro-organisms gave no very definite results. An innumerable host of bacteria, cocci and bacilli, were present in the pseudo-membrane and in the necrotic tissues; in the centre of these masses they were about equally distributed, but one receives the impression that, in the tissue surrounding, the bacilli of the colon-typhoid morphology and staining properties predominated, but it is, of course, impossible to say that these were all Shiga bacilli. In the milder grades of inflammation the organisms of any kind were few in number, very superficially situated, and no particular type predominated. In this series of cases the organism invaded the submucosa in only one case (XV).

In the examination for bacteria in the sections my findings agree more nearly with those of Flexner[3] in adult cases, who found a general admixture of organisms on the surface of and in the mucosa with a submucosa uninvaded, rather than with those of Strong and Musgrave,[4] who found organisms not only in the mucosa but all through the areolar tissue, muscularis mucosæ and submucosa, down to the muscular coat.

It is interesting at this time to compare somewhat in detail the pathological findings in these cases with those observed by Flexner, and Strong and Musgrave in Manila, the specific germ being the same. When we do this we find that only one of these groups (A) is comparable in any way with their cases, though this bears many striking resemblances to the Manila cases. There is a pseudo-membrane composed of necrotic tissue, emigrated and desquamated cells, and myriads of

bacteria. Flexner lays great stress on the fibrin in this pseudo-membrane, while Strong and Musgrave do not mention its presence. A moderate amount of fibrin was found in some, not all, of my cases. The submucosa is much affected according to these observers, and this was my observation, and the changes were the same; but Flexner speaks of much fibrin formation in this coat as well as hemorrhages, the former of which Strong and Musgrave do not mention, nor did I find fibrin or hemorrhages in this situation save in Case XXVII, where hemorrhage continuous with that in the mucosa was found. Flexner also says that the submucosa may be affected with an intact or almost intact mucous membrane, while in my cases when the submucosa participated in the process, it was only when the mucous membrane was greatly damaged. Case III is an exception to this rule, the submucosa being a little affected, while the mucosa is practically normal. Flexner does not speak of, but Strong and Musgrave mention, subacute cases with hyperplasia of the solitary follicles and superficial erosions, which suggests my group (B) with the follicular excavations. The other varieties that I have described find no prototypes in the published accounts of Manila cases.

The foregoing report shows unmistakably that cases of Shiga-bacillus infection exhibit most diverse pathological anatomy. The gross and microscopical changes of the extremes of these cases are so different that at first sight it would seem scarcely probable that they are caused by the same micro-organism. There are indeed many considerations which must be taken into account before a final opinion is passed upon the question as to what extent the lesions found are to be ascribed to the action of this bacillus.

It seems to me that in discussing this point, which is among the most important of all, we cannot afford to disregard the facts of clinical observation. A moment's reflection on the clinical course of the diarrhœas of infants brings forcibly to our attention the common observation that some cases are extremely mild and respond almost immediately to ordinary therapeutic measures. In conformity with this fact can be stated on the basis of my observations that a large percentage of fatal cases fails to show evidence of profound structural lesions. In view of the slight nature of these lesions the question arises as to what extent the infection is to be conceived as a cause of death in infants.

As regards this question it may be said immediately that among these cases a percentage must be looked upon as intercurrent or so-called "terminal" infections in children already debilitated by previous disease, whereas in the remainder the very fact that the children are institutional children in a very depreciated state of health must be considered. It seems, therefore, to me that these slighter grades of infection in more vigorous infants are the ones possibly which respond so promptly to remedial measures.

In considering the severer lesions, particularly the ulcerative ones, the question immediately arises as to what extent the entire process is to be regarded as due to the Shiga bacillus. We are here confronted with the identical problem that has to be considered in dealing with similar infections in adults, and thus far it has not been possible to separate sharply the damage done by the Shiga bacillus and that which is subsequently done by the whole host of micro-organisms, pyogenic and others, normally contained in the intestinal tract. This much may be said, the evidence is in favor of the belief that the primary necrotic lesion is the result of the action of the bacillus of dysentery, the subsequent ulceration being brought about not improbably by the interaction of various micro-organisms and the ordinary processes of demarcating inflammation. Beyond this point it does not seem possible to distinguish the action of the various micro-organisms in the intestine.

The lesions in the intestine in children, as in adults, must for the present be conceived to be of two kinds: first, those due to the action of the dysentery bacillus, as already explained, and, second, of toxic products of this and perhaps other organisms as shown by the lesions of the submucosa and elsewhere, among which the micro-organisms have not been discovered. In this regard there is a conformity in the conditions found in children and in adults.

It is important to take cognizance of the fact that, after all, in my cases the lesions found were not usually typical pseudo-membranous inflammations; the pseudo-membrane appeared either on the surface of ulcers or as isolated areas upon the mucous surface of the gut. In this regard the changes in children seem to be in contrast to those thus far described in adults. But a still further distinction is found in the much more common involvement of the solitary and agminated lym-

phatic structures in children, the same structures in adults usually escaping participation in the pathological process.

If we endeavor to sum up the case as is here made out for the Shiga bacillus, we shall have to say, as it seems to me, that there are comprised under the lesions associated with it all grades and types of diarrhœal disease, as distinguished by clinical symptoms and pathological findings, and that it can be affirmed that no particular type is distinguished from the others by a special etiological origin.

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VI.

THE TREATMENT OF ADVANCED CASES OF GENERAL SEPTIC PERITONITIS FROM APPENDICITIS.

With Remarks on the Early Diagnosis of this Condition.

By Forbes Hawkes, M.D.

A little over three years ago the writer had occasion to look into the prevailing mortality records in those cases of general septic peritonitis from appendicitis that were being treated by operative measures, and he became convinced that the mortality rate could be distinctly lowered in these cases if a certain number of methods, all of known value, could be made use of, combined in the particular way and carried out in the particular manner to be described in this paper.

The comparative importance of each detail of these methods was therefore carefully considered, and a grouping effected which, with certain minor changes that have arisen from experience, has been made use of by him in all cases of this kind that have come under his care since that time.

This article embodies the results of this work in full. Eleven consecutive cases are here recorded with two deaths—a mortality rate of eighteen per cent. The cases here collected have all been operated upon by the writer in the Presbyterian Hospital, New York, during the last two and a half years; they represent all the cases of general septic peritonitis from appendicitis that have been operated upon by him during that period. He would not presume to record in this paper the cases herein mentioned had they been cases in which a favorable prognosis could ordinarily be expected. The almost hopeless state of most of them when first seen by him, followed by the very satisfactory recovery and excellent present condition of all but two, has induced him to advocate most strongly the measures by which their lives appear to have been saved.

GENERAL REMARKS.

The subject of the inflammation of the vermiform appendix in man has of late years, owing to a recognition of the frequent occurrence of this condition, received so much attention from the laity as well as from the physician, that the usual symptoms and dangers of this disease may be said to have become almost popularized.

One of the beneficial effects of the general dissemination of knowledge on this subject is shown to-day in a tendency on the part of the more intelligent patients to seek the advice of their physicians at a much earlier period in the disease than was formerly the case, thereby increasing their chances of recovery.

It can also be said that it happens much less frequently nowadays that the surgeon is called in for the first time after the symptoms of a general septic peritonitis from appendicitis have developed and become unmistakable. To those, however, who are engaged in surgical work in the larger general hospitals, this is unfortunately not so common an occurrence as they would wish.

Patients are, of course, occasionally seen who have been unable to secure prompt surgical advice at the start of an acute attack of appendicitis, and who have, after a comparatively few hours or days of illness, passed into a condition of general septic peritonitis.

Some also have refused proper surgical treatment at a period in the course of their appendicitis when the risk of operation would have been slight.

The mortality rate in cases of "*general*" septic peritonitis from appendicitis, under any form of medical or surgical treatment, is still high.

Many of these patients are seen to be in or near the prime of life, and to have families dependent upon them for their support. They form a class, therefore, which is of the utmost interest to the surgeon to-day, and the question of their treatment is well worthy of his most earnest attention and study.

THE EARLY DIAGNOSIS OF THE AFFECTION.

While a certain number of cases of general septic peritonitis from appendicitis are developed without all the plainly evident symptoms

of the affection, many of these symptoms will be found if a careful search for them be made.

In most cases at a variable time after the onset of the attack of appendicitis (and often a few hours or a day or so after apparent amelioration of the symptoms) the condition of the patient is seen to change. The face assumes a more anxious expression, the abdomen becomes more generally rigid; the tenderness is still marked in the right iliac fossa, but the rest of the abdomen also becomes tender and there is a greater degree of distention. The pulse in the very first stage of the generalization of the peritonitis is apt to become more wiry and somewhat more rapid, though from shock it may be feeble.

The temperature is unfortunately not always of distinct assistance. While usually 102° to 105° F., it may remain throughout as low as 99° to 100° F., with quarts of pus in the general peritoneal cavity, or it may drop suddenly from 103° or over to 98° and 99° F., the latter often when a localized purulent collection of some size around the appendix has broken through previously limiting adhesions and is working its way between the intestinal coils.

Often the history given by the physician to the surgeon is that after several days of right-sided abdominal pain with fever (102° to 104° F.) the patient has expressed himself as being distinctly more comfortable. A statement of this kind taken in connection with such a history is extremely suggestive of the escape of pus into the general peritoneal cavity, and physicians whose patients with appendicitis have reached such a stage in their illness without operative interference should regard the occurrence of the symptoms mentioned above as a very distinct warning that within a few hours the suppurative process may extend to the whole peritoneal cavity, and their patients be then beyond the reach of successful surgical intervention.

While the rupture of a large abscess may be associated with sudden and alarming symptoms of shock, such as collapse with almost imperceptible pulse, low temperature, etc., it is found that many of the cases of "perforation" develop their ensuing general septic peritonitis gradually—evidently through a minute but constant leakage, and the sudden symptoms of shock are then absent or very faint—the symptoms of the general septic peritonitis showing out more and more plainly as the condition progresses.

It is to the absence of sudden and alarming symptoms of shock that is due the willingness apparently on the part of some practitioners to allow their patients to continue in the disease, under medical treatment only, in the belief that it requires a distinct "perforation" to bring about a condition of general septic peritonitis, and that such a perforation is invariably ushered in by the usual symptoms of shock. Unfortunately, this is not always the case, for a certain number of patients develop their general peritonitis without any associated "perforation"—simply from an extension of the inflammatory process through the appendix wall to its peritoneal coat, and thence by direct contiguity to the visceral and parietal peritoneal layers—the inflammation spreading quickly all over the peritoneum.

An ever-mindful realization of the possibility of this latter occurrence by those practitioners who are in the habit, owing to existing circumstances, of treating many of their appendicitis patients without surgical measures, would doubtless save the lives of a certain number of these, for the occurrence of this form of spreading infection is far from infrequent. This variety seems often to be of more rapid development, and to run a shorter course, probably on account of the frequent absence of limiting adhesions.

SYMPTOMS.

These are mentioned in detail in the order of their apparent value in diagnosing the condition at an early period.

Abdominal Rigidity.—This symptom is worthy of very careful consideration. During an attack of appendicitis in which the inflammation is limited to the region of the appendix we find this rigidity confined, as a rule, to the right rectus muscle, that segment of the muscle which overlies the inflamed area exhibiting this rigidity in a more marked manner than the other segments. For this reason the writer is in the habit, in all appendicitis cases, of testing with extreme care the various segments of the right rectus muscle, and comparing them closely with those of the opposite side.

In "*general*" septic peritonitis from appendicitis both recti muscles will be found at an early period to be distinctly rigid, and if seen before the abdominal distention has extended sufficiently to cause marked

ballooning of the anterior abdominal wall, the segment of the right rectus which overlies the appendix area will be found to preserve its correspondingly greater rigidity. The lateral abdominal muscles offer at times some help in differentiating this condition, but do not afford as delicate or as early a test as do the recti.

The writer has never seen in any case of general septic peritonitis from appendicitis that most intense degree of abdominal rigidity which he has seen in some cases of suddenly perforated gastric ulcer. It may well be that the reason for this lies in the fact that many of these appendicitis patients are in fair general health when attacked, and have therefore comparatively thick abdominal walls, whereas most of the gastric-ulcer cases have had a previous period of illness due to the stomach trouble and are apt as the result to have rather thin abdominal walls, the intense rigidity being more appreciable under the latter conditions.

The writer feels justified in stating that he attaches almost supreme importance, when a history is given of pain in the right iliac fossa with fever, to the presence of increasing general abdominal rigidity as indicating an extensive and spreading peritoneal inflammation. This symptom should therefore be very carefully sought for in each case.

Abdominal Tenderness.—The personal factor enters often into this symptom. Gentleness of manner in the palpation, together with the ruse of distracting the patient's attention from the abdominal region by questions concerning the functions of other parts of the body, will almost invariably secure for the examiner the desired information concerning the location and comparative amount of the abdominal tenderness present. Distinct tenderness on the other side of the median line, while not absolutely characteristic of spreading peritonitis, should lead us in almost every case to suspect its inception.

Reflected tenderness on deep pressure is not a valuable sign, for the author has often seen this sign present in acute forms of appendicitis with little or no peritoneal involvement.

The existence of a previous neurasthenic condition in a patient should receive a certain amount of weight when testing for abdominal tenderness, but this factor should be eliminated by the method of abdominal palpation mentioned above.

Abdominal Pain.—In appendicitis, as in other conditions of disease,

the severity of this symptom is extremely variable, depending probably in part on conditions in the appendix region, the nature of which it is hard to recognize in our examination; for diagnostic purposes the apparent amount of pain in any given case is not as valuable a symptom as is the sudden cessation of that pain, especially in the cases where the attack has lasted from one to five days or longer, and a mass has developed in the right iliac fossa. This *sudden relief from pain* will be found, as previously stated, to be due, in the majority of cases, to the rupture of an abscess into the general peritoneal cavity, and clinically we find that the symptoms of shock are often scarcely noticeable at that time. This latter symptom calls for immediate operation.

Abdominal Distention.—This symptom is often absent during the earlier stages of the generalization of the process, being held in check apparently by the tonic contraction of the abdominal wall. Later the distention becomes often extreme, obscuring greatly the comparative amount of rigidity of the various muscular segments. When distinctly noticeable it is considered as an unfavorable symptom, for it is often associated with obstinate constipation, and may be interpreted usually as indicating an advancing paralysis of the bowel. The writer has not seen a "soft" distention of the abdomen in general septic peritonitis from appendicitis. The distended abdomens seen have always been "hard" from the muscular rigidity previously mentioned.

Facial Expression.—The change in facial expression noted in cases of appendicitis that are "not doing well" is well known. That this change is due to a beginning septic absorption seems reasonable. While it cannot be said to designate a beginning generalization of the peritonitis in every case, it certainly is found in a large percentage of the cases at a comparatively early period in the disease, and it seems to be a good clinical deduction that when this symptom is present the peritonitis has passed, or is passing, the line of demarcation between a conservative process and a diffused septic one. The writer considers it as a very valuable sign when interpreted in this way. In some cases the patients have a "sick look," in others an "anxious expression," the latter being a reflection seemingly of the amount of "abdominal distress" present.

Pulse and Temperature.—These two symptoms are often considered together on account of their interdependence in many conditions of

disease. Of the two, the pulse is of greater importance, and of its quality and rate the former is perhaps of more general assistance. As previously stated, a spreading peritonitis is often associated at the start with a wiry pulse of 100 to 110 beats to the minute. If we can rule out the presence of a heart lesion, a poor pulse of any frequency is a grave symptom. A pulse rate of over 120 in an adult should be viewed with decided suspicion.

Too much reliance should not be placed on the degree of temperature. A gradual decline of the temperature to normal has, however, never been noted in the beginning of a general septic peritonitis, rapid elevations, from 99° to 104° and 105° F., are often seen, and a rapid fall with the slightest symptoms of shock is very suggestive of a spreading peritonitis from rupture or leakage. Cases of general septic peritonitis are continually reported which have not shown at any time a higher temperature than 99.5° F., and a higher pulse rate than 98 to 100. In these cases the quality of the pulse, however, will probably reflect the amount of septic absorption that is going on.

Respiration.—As soon as abdominal rigidity appears, the respiration becomes somewhat more thoracic and rapid than normal, and this symptom will be found to vary very uniformly with the degree of abdominal rigidity present. The neurasthenic factor also enters at times into this symptom.

Constipation.—This symptom, present at an early period in most cases of appendicitis (usually in about ninety per cent. of the cases), is apt to be more marked with the onset of the general peritonitis. Diarrhœa is occasionally met with, but is not usually seen until the sepsis has existed for some time.

Nausea and Vomiting.—These are variable symptoms; few patients with general septic peritonitis escape them. The vomitus, as in general septic peritonitis from other causes, is apt to be at first of mucus, then of yellowish or greenish fluid, later of a dark-brown or green color with varying odor, and still later of coffee-ground character. These are followed before death by the typical vomiting of intestinal obstruction in some cases. It does not seem possible to judge of the exact stage of the peritonitis by the quality of the vomitus or by the frequency of the vomiting. Occasionally there is no vomiting whatever throughout the attack.

Chilly Sensations, Chills, and Sweating.—These symptoms are often present before the peritonitis starts to become general, and are considered rather as indicating the probable presence of a purulent collection in or about the appendix than as foreshadowing the generalization of the peritonitis. No safe conclusion can be drawn, however, from their absence.

Hiccoughing.—While undue importance is often attached to this, the writer feels, from a careful observation of this symptom in these cases, that it may be considered as suggesting the probability of a considerable degree of peritoneal irritation. Its gravity rests rather on the fact that, if frequent and long continued, it tends, through the associated muscular spasms, to disturb that constant and even splinting of the abdominal contents in the appendix region which Nature seeks to bring about with the help of the tonic contraction of the overlying and neighboring muscles (right rectus and lateral abdominal muscles).

Icterus.—While a very slight degree of icterus is often observed in cases of appendicitis which are doing well, a marked increase in this symptom is seldom seen except toward the end in septic cases. It cannot, therefore, be counted upon as an early sign of the generalization of the peritonitis.

Cyanosis.—When there is no valvular lesion or pulmonic affection, this symptom is rarely seen, unless it be late in the disease in septic cases.

Absence of Liver Dulness.—As one would expect, this sign has not been noticed early in any case. It is variable in the late stages of the process.

Mental Condition.—We can hardly place a change in the mental condition of the patient as a reliable and early sign of the generalization of the peritonitis. Late in the disease apathy is often seen. Information on the early appearance of this symptom was hard to obtain in these cases. Many of them were foreigners and brought in by the ambulance.

Increased Frequency of Urination or Retention of Urine.—These symptoms cannot be relied upon to influence an early diagnosis of general septic peritonitis, for they are very variable and seem to depend rather on the situation of the appendix than on the extent of the peritoneal involvement.

The Examination of the Patient.—*Palpation of the Abdomen* in these cases should reveal to us the comparative amount and location of the abdominal rigidity and of the tenderness, and the degree of distention present. It may reveal also the existence of a mass in the right iliac fossa (collection of pus, agglutinated intestines, rolled-up omentum), and of free fluid in the general peritoneal cavity.

This procedure, which should be done with gentleness even in mild cases of appendicitis, should be carried out in cases where a beginning general septic peritonitis is suspected with the greatest of care, for fear of rupturing adhesions that may exist around a suppurating appendix, thereby liberating some pus into the general peritoneal cavity. Attempts to palpate the appendix itself in these cases are absolutely unjustifiable.

Percussion of the Abdomen in the beginning of a general septic peritonitis may help somewhat to decide the question as to the exact location of a "mass," whether situated directly under the abdominal wall, or more deeply under overlying coils of intestine. The distinction between a collection of pus and a roll of inflamed or adherent omentum can hardly be made out by percussion.

Percussion does not help us in our decision as to whether the peritonitis has just started to become a general process, for small quantities of sero-fibrinous or sero-purulent exudate between the coils of intestine do not seem at first to alter the percussion note appreciably. By gentle tapping a distinct fluid wave may be occasionally felt late in the disease when a considerable amount of fluid exudate has collected. Exaggerated tympany may usually be elicited over most of the abdomen as soon as it becomes even moderately distended. Very light percussion only should be indulged in for fear of setting free a thin-walled collection of pus.

Auscultation of the Abdomen will not help us in the earliest stages. The absence of peristaltic gurgles, if noted during several minutes of auscultation, is presumptive of a marked degree of intestinal paralysis.

No gurgles were heard in most of these late cases; no time was wasted, however, in listening persistently for these sounds.

Succussion of the Abdomen is undesirable both on account of the pain which it induces, and because of the possibility of forcing a puru-

lent collection beyond its existing limits. The differentiation also by these means between the combination of fluid and gas in the peritoneal cavity and that in the gastro-intestinal tract is difficult, if not impossible.

Rectal Examination in men or *Vaginal Examination* in women may reveal a distinct "fluid bulging" in the recto-vesical or in Douglas's pouch. Free pus in this situation can occasionally be suspected from this sign. Pus from the appendix seems often to gravitate at an early period toward the pelvis, and this symptom may therefore help in an early diagnosis. A previous adhesive pelvic peritonitis in the neighborhood of tubes and ovaries may obscure this symptom.

Urinary Examinations made before operation have not been of assistance in making a diagnosis of general septic peritonitis, early or late; they have been of value, however, when the question has come up as to the amount of anæsthetic that the patient could safely stand.

Leucocyte Count.—Owing to the information which a leucocyte count may give in suppurative conditions, a count should be made whenever practicable before operation. Many of these patients, however, were brought to the hospital in the middle of the night, and the existence of the suppurative process was so clear and the condition such an urgent one that the procedure was not carried out at that time in every case.

A post-operative count was made from time to time in many of them, and the data thus obtained compared with the behavior of the wound and with the patient's general condition.

With regard to diagnosis and to prognosis the writer allows himself to be influenced by the leucocyte count in the following manner:

(*a*) A high or increasing leucocyte count before operation suggests very strongly the presence of pus.

(*b*) A low leucocyte count, with marked symptoms of general septic peritonitis, indicates often an extremely grave condition.

(*c*) A normal leucocyte count may exist with the abdomen full of pus.

(*d*) A high and rising leucocyte count after operation indicates that suppuration is probably spreading; it may be localizing itself, however, in one of the various dependent portions of the abdominal cavity.

(*e*) A leucocyte count which gradually diminishes toward normal

after the operation suggests recovery. A subnormal leucocyte count which diminishes still further after operation is not a good sign.

It may be gathered from the foregoing that, given a fairly straight history of an existing attack of appendicitis, the most valuable symptoms in making an early diagnosis of a "general septic peritonitis" (that is, of a *beginning* peritonitis which, if allowed to run its course, will soon become a general one) are these:

Beginning rigidity of both recti muscles, with beginning general abdominal tenderness, associated with a sick or anxious expression of the patient's face, together with a rapid and wiry or a weak pulse—these symptoms coming on either gradually, beginning a few days after the onset of the attack of appendicitis, or more or less quickly after a period of apparent improvement.

TREATMENT.

As in the case of the syphilitic child whose treatment should be started, it has been said, in the mother before the child is even conceived, so here it may be said that the treatment of general septic peritonitis from appendicitis should be started by the removal of the offending appendix before the peritonitis has been allowed to become general.

That this radical view has gained ground during the last few years among general practitioners of medicine is certain, and this is why fewer cases of this kind are now seen by the surgeon.

This paper deals, however, only with the surgical treatment of the process after it has become "general."

There are, of course, cases of general septic peritonitis from appendicitis that have passed beyond the help of surgical intervention when first seen by the surgeon—the patient being in the last stage of sepsis; but if we except these, it is the writer's firm belief that certain surgical methods within our reach constitute at the present day by far the best form of treatment for this condition of general septic peritonitis, and that if we consider carefully the mortality rate in a fairly large number of cases operated upon under nearly similar conditions, we shall find that the rate will vary very distinctly according to the value that is placed on the underlying principles, and the thoroughness, therefore, with which the procedures mentioned in this paper have been carried out.

A tendency to turn from surgical methods in these critical and heretofore usually helpless cases arises at times from an apparent dissatisfaction with the principles of treatment adopted. In the writer's opinion the fault is to be found rather in the imperfect use that is often made of the various methods within reach.

Given an appendicitis patient who is in such a condition of sepsis from a general peritonitis that it seems extremely doubtful whether an operation can be successfully performed, but of whom it cannot be said positively that death would occur before a thorough operation could be completed, are we justified in recommending the operation?

The cases here collected have gone far toward helping the writer to settle this question in his own mind. While no good argument can be brought forward for operating in those cases in which the surgeon believes that there is no chance whatever of recovery, the condition being in its last stage, it certainly seems proper to offer operation to those patients for whom the slightest hope of recovery can be said to exist; in other words, operation should not be refused to those for whom a possibility still exists of their being removed alive from the operating table after the thorough but quick method which is described in this paper.

The first duty of the surgeon is to his patient; his tendency will rather be to give to him whatever chance (however small he thinks it may be) of recovery, and at the same time to do what he can in this way to correct a possible error on the part of the practitioner in having allowed the patient to go too long without insisting on surgical advice.

OPERATIVE TREATMENT.

Between the confirmation of the diagnosis by the surgeon and the inception of the operation some time usually elapses during which the necessary preparations of the patient and of the operating room, etc., are carried out.

1. During this time a mental review of the probable steps to be followed is of great value to the operator, in that it tends to hasten his own operative procedures and does away with a possible delay in waiting for instruments and appliances that have not been prepared, solutions of the right temperature, etc. This has been the

writer's practice in all cases, and a saving of an appreciable amount of operative time has thereby certainly been effected.

2. (*a*) The anæsthetist is not allowed to start in with the anæsthesia until every appliance, apparatus, solution, etc., is absolutely ready; the sterilized instruments are laid out, the needles threaded, the salt solution heated up to about the temperature required (and hotter solution is at hand to bring the solution up to the proper degree within a minute), the sponges are ready for use, the cautery point is kept in readiness over a flame and directly at hand; so are the gauze and the rubber tissue for the drains, etc.

(*b*) If possible, the patient should be anæsthetized on the operating table. Many valuable minutes are often saved by the latter procedure, for the final cleansing of the skin of the abdomen can be started before the patient is entirely under, and will be found to be completed usually by the time the surgeon is ready to incise. If the sight of the operating room be deemed detrimental to a nervous patient, a light handkerchief or piece of gauze over the face eliminates this factor. These patients are often dull from their sepsis and are not impressed by their surroundings.

All these details, while seemingly insignificant, cause a total saving of time which the writer considers of more importance in these cases, perhaps, than in almost any others.

3. *Choice of Anæsthetic.* — With a competent anæsthetist and the proper apparatus the writer prefers "gas and ether"; for a sudden weakening of the heart seems less likely to happen with this combination. The necessity, therefore, of disturbing the operative field and of removing the instruments, with the resulting delay while measures for artificial respiration are carried out, is not so apt to occur.

Local anæsthesia is not adapted to these cases. Spinal anæsthesia is, in the writer's opinion, altogether too depressing and unreliable; its use is not warranted in this class of cases.

4. *Position of the Patient.* — The dorsal position with the chest slightly elevated at first is the best one. The Trendelenburg position should never be used, for this would allow more of the pus to travel quickly by gravity toward the diaphragm as soon as the abdomen was opened. At a later stage in the operation, during the irrigation, the chest is raised still higher, and with it the upper part of the abdomen for the purpose to be mentioned.

OPERATIVE PROCEDURES.

5. (*a*) *Rapidity of Technique.* — The writer feels that in this class of cases perhaps more than in any others the rapidity of the operative technique is the most important factor in the patient's recovery. While in many cases of appendicitis with only beginning general septic peritonitis (*i. e.*, spreading peritonitis) it seems as if the difference of ten to fifteen minutes or perhaps more in the operation may not perceptibly affect the result, the patient being in fair condition at the time, in the class of cases here dealt with, where the condition is a desperate one, an operation of fifteen minutes or so will often be tolerated, where one of fifteen to twenty minutes longer duration will prove rapidly fatal. Every extra minute of required anæsthesia seems to diminish somewhat their chances of recovery.

The previously mentioned mental review on the part of the surgeon, before the operation is begun, of the probable operative steps is a distinct help to him in this direction. All operative measures should for this reason also be extremely simple; complicated ones take more time, for they are usually less familiar both to the operator and assistants.

The question as to the wearing of rubber gloves by the operator and assistant is here pertinent, because it is urged by some that by interfering with the delicacy of touch they increase the time consumed in the operation. Owing to the thinness of the rubber gloves now obtainable, there is only a very slight difference of sensitiveness between the gloved and the ungloved fingers, and this is more than compensated for by the increased sensitiveness of the fingers themselves, from the absence of the oft-repeated scrubbings and immersions in strong chemical solutions during the operation which were formerly found necessary to keep the hands even fairly aseptic.

After more than five years' use of rubber gloves in practically all operations and in almost all dressings and vaginal and rectal examinations, the writer feels that he can truthfully say that the sensitiveness of his gloved fingers at the present time is fully equal to that of his ungloved ones before the rubber-glove period, and that the delicacy of touch of the fingers themselves is much greater now than formerly.

It must be said also that the gloves are an excellent protection to the patient against the introduction of different varieties of bacteria from those already present in the peritoneal exudate, absolute sterilization of the human hand being, as is well known, an impossible achievement.

(*b*) *Choice of Incision.*—For these general septic peritonitis cases an incision made through the fibres of the right rectus muscle, near the outer edge of its middle portion, would seem to afford several advantages.

1. Entrance into the general peritoneal cavity is quickly effected by this incision (often one-half to one minute is sufficient).

2. Easy access to the appendix region is afforded; extreme retraction of the wound edge is not usually necessary.

3. It can be easily and quickly enlarged above or below if desired.

4. The most dependent portion of the pelvis is of easy access through this incision.

5. It does not seem to predispose toward post-operative hernia.

(While several of the cases here mentioned were operated on through the intermuscular (McBurney) route, the writer feels that unless the operator is very familiar with this method it does not afford as good an opening for these cases as the one mentioned above.)

No time is spent on ligating bleeding vessels in the abdominal incision. Clamps are applied and left on till the end of the operation; when they are removed, it is usually found that they have permanently arrested the bleeding.

(*c*) *Rapid Attack on the Right Iliac Fossa.*—Two fingers are immediately introduced, passed down to the appendix region, and the diagnosis of the primary appendicitis confirmed. The removal of the appendix should then be immediate. Two large moist and hot gauze pads (wrung out in hot normal salt solution) are introduced to the appendix region to keep the rest of the intestines from obstructing the field of operation. They are also time-savers in that they serve to soak up considerable quantities of the pus in the vicinity while the appendix is being removed. The mesentery of the appendix is clamped and divided, and the appendix amputated between a proximal ligature of heavy catgut and a more distal clamp, the stump being immediately cauterized very thoroughly with the Paquelin.

This is the simplest method of appendicectomy, and certainly seems clinically to be equal if not superior to more complicated procedures.*

Catgut is used as ligature material throughout the work on the appendix. It will not furnish a nidus for pus colonies, as is often the case with silk.

(*d*) *The Confirmation of the Diagnosis of General Septic Peritonitis from Appendicitis.*—At this part of the operation the diagnosis of "*general*" septic peritonitis should be confirmed or refuted in the following way:

A fresh sponge or piece of gauze on a sponge-holder is passed just under the anterior abdominal wall to the following areas:

1. To the subhepatic and epigastric areas.
2. To the splenic area.
3. To the left iliac fossa.
4. To the pelvis.

Upon withdrawing it, each time it is "squeezed dry" and the presence of pus or purulent serum in appreciable quantities thus noted.

It can be said that we are justified in making a diagnosis of "*general*" septic peritonitis (as distinguished from "*spreading*" peritonitis) from appendicitis when we have

(1) A distinctly inflamed appendix (it may be thickened and stiffly erect, or perforated or gangrenous), *and*

(2) the intestines *throughout* are evidently congested and inflamed and bathed in free pus or purulent serum, *and*

(3) the pus or purulent serum is present in all the localities above mentioned, *and*

(4) no other lesion is present to account for the condition.

The cases collected in this paper are those in which this sponge test was made and pus found under the conditions and in the localities

* This method of removing the appendix and treating the stump has been used in a large proportion of the cases of appendicitis with or without suppuration operated upon in the Presbyterian Hospital during the last ten years. It has been found extremely satisfactory. The abdomens of several of these patients (upon whom an appendicectomy had been done in this way) have been opened by the writer during the last few years for other troubles not connected with the appendix region (usually ovarian or tubal lesions which have subsequently developed), and the region of the appendix stump in these cases has been carefully noted as free from adhesions; the situation of the stump has usually been represented by a small dimpled area with a central darkish spot.

mentioned, the diagnosis of "*general*" septic peritonitis being deduced therefrom.

The writer does not feel that a positive confirmation of the diagnosis of "*general*" septic peritonitis can be made in any other way but this, unless an extensive enlargement of the incision be made upward toward the liver for this purpose—usually an unjustifiable procedure.

Cases of *spreading* peritonitis where the free pus was found in the appendix region and deep in the pelvis, also extending up to the level of the umbilicus, but *not to the subhepatic, epigastric, and splenic areas, have not been included among those here reported,* for the proof of the generalization of the process was wanting.

(*e*) *Irrigation of the General Peritoneal Cavity.*—The ultimate result obtained in any given case will often be influenced to a very great extent by the thoroughness with which this procedure can be carried out. It is the one step of the operation where a most careful and methodical routine should be followed if possible.

The solution used is the sterile normal salt solution at a temperature of 110° to 115° F. The quantity to be used may be said to be extremely variable, depending upon the amount and thickness of the purulent exudate—enough in each case to cause a clear return from all over the general peritoneal cavity. Usually several gallons are necessary for this purpose. The elevation of the irrigating solution above the patient's abdomen is about five feet. Directly after the removal of the appendix, the abdominal pads are taken out and the flushing started as follows:

The patient's chest and upper abdomen are further raised by an extra pillow or pad placed under the back, and a *large* Chamberlain tube connected to the rubber tubing of the irrigator is introduced (while the solution is running at the proper temperature) upward to the subhepatic, epigastric, and splenic areas. In this way the upper (subdiaphragmatic) portions of the general peritoneal cavity are irrigated out *first*, and the solution, falling by gravity to the more interior portions of the cavity, wells out below mixed with the pus from the other portions of the abdomen as well. The nozzle of the Chamberlain tube is moved around gently into the various normal pockets in the upper part of the abdomen, flushing them out until the portion of the liquid coming from above and showing itself in the upper part

of the abdominal wound is coming out pretty clear; then it is brought gradually down on the outer side of the ascending colon on the right and of the descending on the left, flushing these recesses thoroughly. The fingers of the left hand guide the nozzle then again upward between the anterior abdominal wall and the omentum to the lower bower of the stomach, and this locality is likewise flushed. Similarly the tube is passed up, if possible, between omentum and loops of small intestine, and then brought gradually downward, first on the right side of the mesenteric attachment of the small intestine as far down as the ileo-cæcal junction, then on its left side similarly as far as the brim of the pelvis, the nozzle insinuating itself continually in a gentle way between the various intestinal loops. The intestines are kept throughout in the abdominal cavity.

The abdominal wound is covered, if straining on the part of the patient necessitates it, by a hot sterile gauze pad, to prevent evisceration. When the fluid is seen to return clear from all these points above, the nozzle is passed to the bottom of Douglas's cul-de-sac, and this most dependent portion thoroughly flushed out. If the patient's condition will stand it, these procedures are again gone over, but more rapidly this time, in the same order from above downward. If the solution is at the proper temperature and these steps are carried out gently, but rapidly, the shock will be found to be slight, if any indeed be noticed. Often the temporary stimulation afforded by this procedure is quite marked.

The time consumed in this thorough flushing of the general peritoneal cavity varies, of course, with the amount and consistency of the purulent exudation. In most of the cases here collected it has taken the operator from five to eight minutes; in several a few minutes more. The amount used has been from two to six gallons, occasionally more. Eventration of the intestines for purposes of flushing necessitates so much handling, even if rapidly done, that it is accompanied usually by considerable shock and cannot be recommended. The wiping of the intestines to remove pus or lymph-flakes does not seem wise for the same reason.

(*f*) *Intra-Intestinal Injection of Sulphate of Magnesia.*—Leaving in the abdominal cavity as much of the salt solution as it will contain, the highest obtainable loop of the small intestine is brought down in

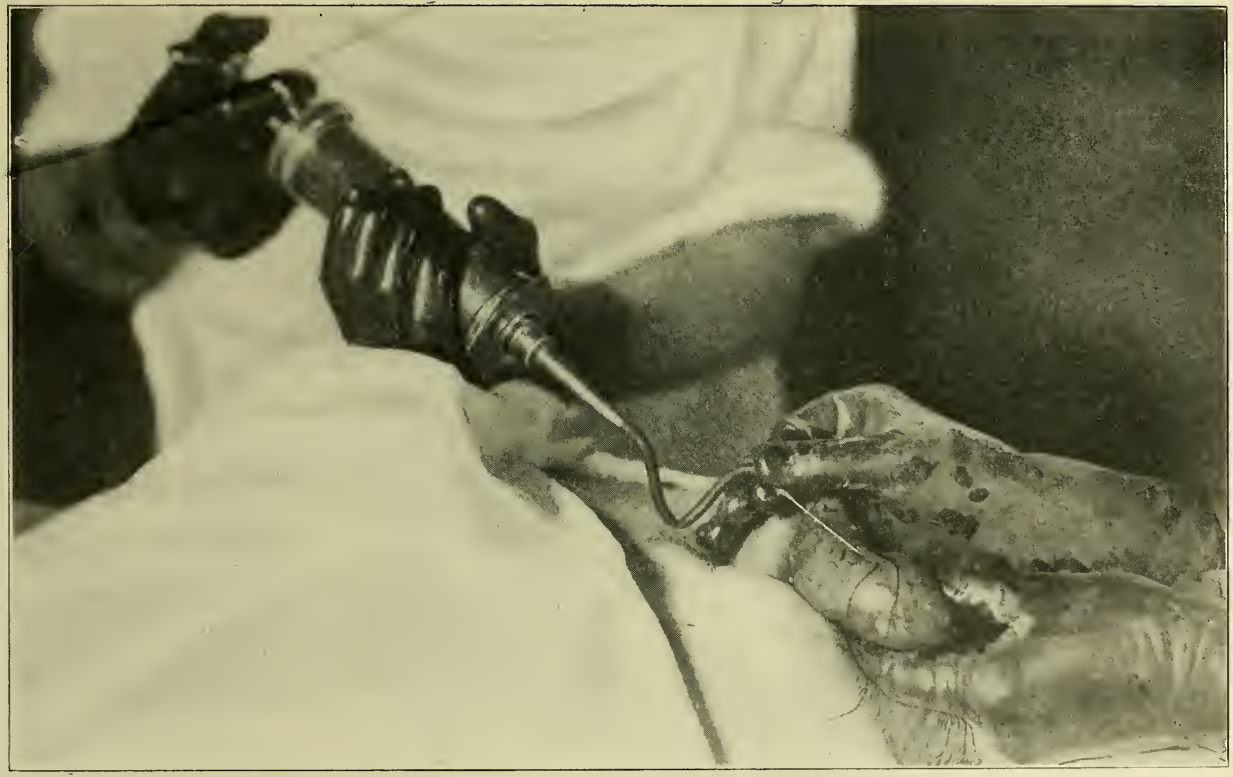

Illustration showing the method of Intra-intestinal Injection of Mag. Sulph. The needle is here connected to the syringe by a piece of flexible rubber tubing. This prevents any sudden movement of the syringe from being imparted to the penetrating needle. A purse-string Lembert suture of catgut is here shown ; this is tied as the needle is withdrawn,

the upper part of the abdominal wound, and one to two ounces of magnesia sulphate, in a hot, watery solution, are injected into its lumen with a sterile syringe; the needle is passed through the bowel-wall quite obliquely; the puncture is then closed by a catgut Lembert suture.

DRAINAGE.

The question of drainage after abdominal operations is at the present day a vexed one; it is not the purpose of the writer to enter into it in this part of the paper further than to say that the principal objection to gauze drainage is that it very soon produces an adhesive peritonitis along its tract, and that on this account it does not actually "drain." While this is undoubtedly true of plain gauze, it is certainly not the case with the drain made up of gauze surrounded by a full rubber tissue cuff, in the manner to be described. Ample proof of this statement has been afforded by the cases here mentioned.

Two drains are commonly made use of: one, of moderate size, leading from the pelvis; another, much smaller, from the stump area. They are made as follows:

(*a*) *The Pelvic Drain.*—A piece of sterile absorbent gauze about one foot square, free from fringed edges and preferably with the selvage on one edge, is rolled up quite loosely, and a piece of rubber tissue about 10 × 5 inches is wrapped around this, loosely also, in such a way that it just comes to the lower selvage end of the roll, or not more than one-eighth inch short of it. (See illustration.)

The lower end of this drain is passed down by means of a pair of long forceps to the bottom of the recto-vesical or Douglas pouch, its upper end projecting from the lower part of the abdominal wound. When the patient is in Fowler's position this drain "drains" all of the abdominal pockets except one (X′).

(*b*) *The Drain to the Stump Area.*—This is made in a similar way, the piece of gauze used being about 12 × 3 inches, and the rubber tissue 10 × 2 inches. When rolled up this drain is about the thickness of an ordinary cigarette. The lower end of this drain is passed down to the appendix stump, its upper end issuing usually at about the middle of the abdominal wound. When the patient is in Fowler's position this drain "drains" the pocket marked X, as shown on the following illustration.

The administration of the anæsthetic is discontinued as soon as the drains are placed and the peritoneal edges of the wound apposed, for the closure of the abdominal incision can usually be completed before the patient "comes out." The various layers are sewed up

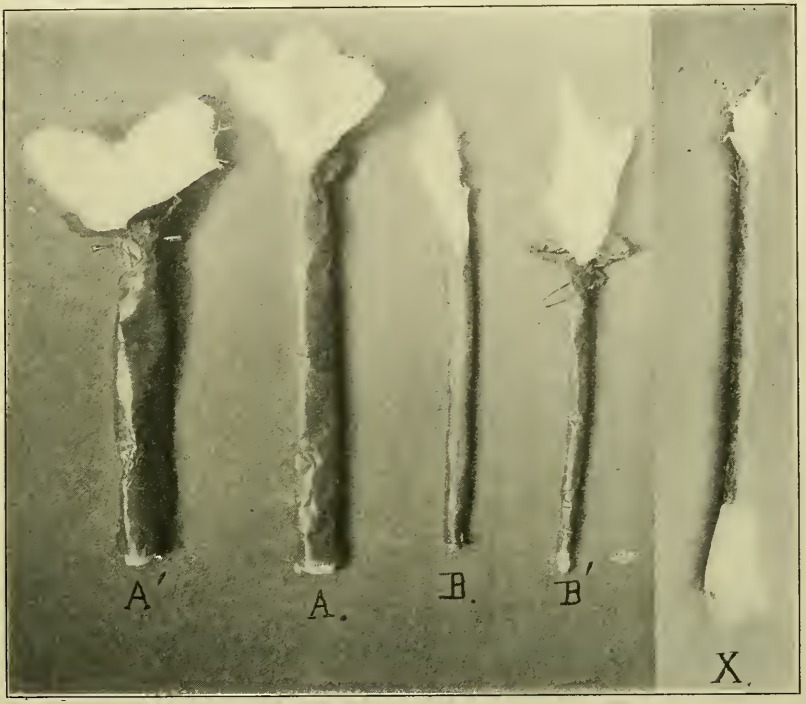

Illustration showing the properly constructed "pelvic" and "stump" drains and an improperly constructed drain.

A and B are the pelvic and stump drains before introduction.

A′ and B′ are the pelvic and stump drains after introduction and transfixed by safety-pin on skin level, and their upper ends unrolled into the dressing.

X is made up of the same amount of gauze and rubber tissue as A and A′ but is rolled too tight, the gauze at the lower end is "fringy" and projects too far.

separately if the patient's condition allows of it, if not, "through-and-through" sutures are used.

A large safety-pin is now passed through each drain where it issues from the abdominal wound, on a level with the skin, and the part of the drain distal to the safety-pin is completely unrolled, thereby allowing

of a greater surface of contact between it and the abdominal dressing; the latter should consist of a large quantity of plain sterile absorbent gauze loosely shaken up before it is applied. The abdominal binder is put on rather loosely also.

Iodoform gauze should not be used, either for the drains or for the abdominal dressing, its capillarity not being apparently as great as that of plain sterilized gauze.

NOTE.—If in the construction of the drains much more than one-eighth inch of the gauze projects beyond the rubber tissue at the lower end of the drain, the formation of a considerable number of adhesions around the gauze at that point will undoubtedly occur, for the drain will be found to "stick" when attempt is made, usually at the end of twenty-four to thirty-six hours, to remove it. With the rubber tissue reaching to the very end of the drain or to within one-eighth inch of it, this does not occur, the *drains coming out easily* and with little or no pain to the patient. These drains do not simply drain from their lower ends; they also drain from their whole length in the peritoneal cavity; the salt solution with its suspended pus cells reaches the gauze in the drain by capillarity after working its way between the layers of the loosely applied rubber tissue. No portion of intestine has ever been found to have forced its way between these layers.

The writer has seen several such drains as were made use of in these cases, and as are here described, removed on the autopsy table from patients who have died within twenty-four to forty-eight hours after operations for various other abdominal lesions where drainage had been provided for in this way between coils of intestine; there seemed to be no adhesions formed between the rubber tissue and intestine, or between the intestinal loops themselves, that were in contact with the rubber tissue.

That a certain number of the cases recorded in this paper might have recovered if the abdomen had been closed without drainage after the thorough flushing, is of course possible, but the writer considers that the form of drain here employed certainly contributed, by actual drainage, to the removal, during the first twenty-four hours, of a certain amount of the purulent secretion from all over the peritoneal cavity, and that by diminishing the quantity of toxic material present, it thereby relieved the peritoneum of a large amount of absorptive work.

The writer feels that the salt solution left in the general peritoneal cavity helps to dilute the purulent secretion from the peritoneal surface, during the first twelve to twenty-four hours at any rate, rendering its suction by capillarity through the drains more certain.

When there is an area of gangrene in the wall of the caput coli where a gangrenous appendix has rested, a closure of the abdominal cavity without drainage would be an unwarrantable procedure, unless the gangrenous portion could be cut out, and the edge of the opening sutured—a proceeding which would require some precious time in a desperate case.

Strychnine hypodermatically and the intravenous injection of salt solution are the two forms of stimulation which the operator has found to be the most reliable during the operation. Some of these patients have also been surrounded by hot-water bags while on the operating table.

POST-OPERATIVE TREATMENT.

Position of the Patient after Operation.—The placing of the patient in Fowler's position immediately after operation is of the utmost importance. The head of the bed is raised about sixteen inches from the floor by means of high blocks.

The rationale of this procedure is too well known now to need discussion. By it the free fluid in the abdominal cavity sinks by gravitation away from the highly absorptive subdiaphragmatic peritoneum to the less absorptive peritoneum of the pelvic floor. From this point in these cases it is sucked out by the capillary pelvic drain into the abdominal gauze, the salt solution taking with it some of the purulent products that are formed.

In other respects the usual post-cœliotomy treatment is here carried out, morphine being withheld if possible.

The abdominal dressing is changed as often as it becomes saturated by the saline. (From the amount which was drained out in these cases into the gauze dressings—which had to be repeatedly changed during the first twenty-four hours—the writer thinks that under these conditions a little more than one-half of the solution left in passes out through the drains, and that the peritoneum absorbs the rest.)

At the end of twenty-four to thirty-six hours the pelvic drain is

removed and the horizontal position resumed, for it is usually found that little or no free fluid remains in the general peritoneal cavity after that time. Should there be, however, any thick purulent discharge in the tract of the pelvic drain when it is removed (an unusual occur-

Treatment of advanced peritonitis.

rence), Fowler's position is continued for another twenty-four hours, and a smaller and shorter drain substituted.

The drain to the stump is left usually for three days, and its place is then taken by a still smaller one for a few days longer.

The intra-intestinal injection of the magnesia sulphate usually causes the bowels to move freely within twenty-four hours; small doses of calomel followed by salts and supplemented by enemata are used on the second day if necessary.

Free stimulation of the patients in these cases is almost always required. On account of their condition it is given hypodermatically or by rectum.

The occurrence of hernia will vary of course somewhat according to the methods used in closing the abdominal incision, and will depend also upon the subsequent behavior of the wound.

It is through the courtesy of Dr. McCosh and of Dr. Eliot, on whose services these patients were admitted, that the following eleven consecutive cases operated upon by the writer are here recorded.

The following pages include the histories of these eleven patients. The ante-operative histories are compiled from the hospital records, supplemented by the writer's own notes. The history of the operation is taken from the operator's own notes, which were recorded by him in almost every case within an hour after the operation was completed.

The post-operative notes are compiled from the bedside notes of the hospital, supplemented by the data recorded by the writer after his visits to these patients.

The laboratory reports are transcribed from the records in the pathological laboratory of the hospital.

The leucocyte counts are those recorded in the hospital histories.

The data concerning the present condition of the nine surviving patients were obtained by the writer either by personal visits made by him or through letters written to them asking for detailed answers to the various questions.

The condition of each patient in the latter part of September, 1903, is noted.

4 patients were seen by the writer and examined by him (Cases III, V, VIII, IX).

2 patients were out working; their wives were seen and the data obtained from them (Cases II, X).

1 patient was out arranging for his wedding the next day; his sister was seen (who lived with him) and the data obtained from her (Case VII).

2 patients were working out of town; they were heard from by letter (Cases I, II).

It is a source of gratification to the writer that in these nine cases operated by him not one has had as yet any symptoms of obstruction —a clinical indorsement, so far, of the kind of drainage employed.

These patients are all attending to their duties in the same way that they did before their operation, and it is worthy of note that the only cases that are now really troubled with constipation are those that had this same habit before their attack or attacks of appendicitis.

October 1, 1903.

GENERAL SEPTIC PERITONITIS FROM APPENDICITIS WITHOUT PERFORATION—APPENDICECTOMY—PERITONEAL FLUSHING—DRAINAGE—RECOVERY.

Case I (surgical).—R. B.; aged twenty; single; plumber; England; admitted to Presbyterian Hospital November 13, 1900; discharged December 12, 1900, cured. Family history: A suspicion of tuberculosis. Previous History: Has had scarlet fever and malaria; typhoid fever seven years ago. Present trouble: One week ago was seized with severe epigastric pain, which soon shifted to the right side. He had several chills and some fever. He vomited repeatedly. He has been constipated. His condition has been getting worse steadily.

Condition on Admission.—Patient is well nourished and muscular; he looks "sick." Temperature, 100°; pulse, 98 and weak; respiration, 24. Chest: Heart and lungs normal. Abdomen: The whole abdomen is held very rigid; there is general abdominal tenderness, the right side is more tender than the left, and the spot of greatest tenderness is over the appendix region. Distention is moderate, tympany all over, no dulness noted in the flanks. He is vomiting "coffee-ground" material at frequent intervals.

Operation Immediate, November 13, 1900 (Gas and Ether).—Incision at outer border of right rectus, high up. Free pus and serum in general peritoneal cavity. No limiting adhesions. Lymph-flakes scattered throughout; small intestines markedly congested and covered with irregularly distributed exudate. Cultures made. Appendix was found to the mesial side of the caput coli, six inches long, thickened and erect, pointing directly upward toward the anterior abdominal wall among the intestinal coils and bathed in pus. Rapid appendicectomy with cauterization of the stump. By means of strong retraction above, the sharp edge of the liver was seen; it was bathed in pus and there were lymph-flakes on it. Sponge on holder passed

over to splenic area is withdrawn full of pus; the pelvis is also full of pus. General peritoneal flushing by the method described; the patient's condition was such that it was thought best not to take any extra time for the intra-intestinal injection of magnesia sulphate. Gauze and rubber tissue cuff drainage. Abdomen sewed up rapidly with through-and-through silk-worm gut sutures; heavy abdominal sterilized gauze dressing.

Patient had to be stimulated during the operation, and again on leaving the operating table. Fowler's position on reaching the ward. He vomited frequently for the first twenty-four hours and had a moderate amount of hiccoughing. Calomel and salts were given by lavage with good result. Large drain removed on the second day, other on the fourth. Distention persisted for several days. There was slow but gradual improvement and on December 6 he sat up in bed, and on December 12 he left the hospital with a small granulating sinus.

Appendix (operator's note).—The whole organ is swollen and the peritoneal coat seems thickened. The mesenteric border seems a little rigid. When split open there is seen near the base a spot where the mucous membrane is bluish-black, as if there had been a hemorrhage.

Cultures (laboratory report).—No bacteria—only fungi. This culture was probably contaminated.

Present Condition of Patient (two years and ten months since operation).—By letter, September 15, 1903. Patient is now in excellent health; he is working out of the city, calking water-pipes. He had occasionally some abdominal pain during the first year after his operation; since then this has been very infrequent. He is constipated at times. The scar is firm, does not bulge, and gives him no trouble.

GENERAL SEPTIC PERITONITIS FROM APPENDICITIS WITH PERFORATION—APPENDICECTOMY—DRAINAGE—RECOVERY.

Case II (surgical).—W. D.; aged twenty-five; married; Bohemia; laborer; admitted to Presbyterian Hospital January 3, 1901; discharged January 29, 1901, cured. Family history: Negative. Previous history: Negative. Present trouble: Two days ago was seized with abdominal pain, vomiting, and fever. These lasted for twenty-four hours or so, then suddenly subsided. This was a few hours before

entering the hospital, late in the afternoon. At that time there was only slight rigidity to the abdomen on the right side, and only slight tenderness to deep pressure in the right iliac fossa, and the patient looked fairly well. Temperature, 100.4° F.; pulse, 100 and fair; respiration, 32.

During the night he began to develop pain again in the abdomen, and vomited several times. The next morning, at ten o'clock, general abdominal rigidity and tenderness had appeared, specially marked in the right iliac fossa; some sweating. No mass could be felt. Temperature, 104° F.; pulse, 106 and wiry. Immediate operation advised, on account of the marked rigidity.

January 4, 1901 (Gas and Ether).—Intermuscular incision; free sero-purulent fluid with foul fecal odor in the right iliac fossa; cultures taken; a large appendix was found, angulated and resting on the mesial surface of the caput coli, pointing upward toward the anterior abdominal wall. It was greenish-black, with a perforation in its distal part. There was a spot of gangrene on the caput coli where the appendix had rested. There were some adhesions in the vicinity. Rapid appendicectomy with cauterization of the stump. All the intestines were seen to be congested. Sponges passed above and to the pelvis were withdrawn full of sero-purulent fluid. On account of the gangrenous and putrid condition of the appendix and of the cæcal wall, and considering the fact that the fluid collected in the subhepatic areas and in the splenic region was sero-purulent only, it was decided not to flush the general peritoneal cavity, but to rely on drainage for its evacuation, in Fowler's position. The pus in the pelvis was sponged out. Gauze drain with rubber tissue cuff passed to pelvis, to stump and above. Fowler's position on reaching the ward, and for forty-eight hours afterward. Drains to pelvis and above removed in twenty-four hours, other on the third day. Patient did very nicely except for the formation on the fourth day of a fecal fistula; this closed, however, on the ninth day and did not reopen. The temperature and pulse-rate fell gradually after the operation, and reached normal on the tenth day. Patient sat up in a chair on January 22, and was discharged on January 29, 1901, with a fair scar.

Appendix (operator's note).—The organ is four inches long; it has a large clubbed end which is gangrenous; there is a perforation on

its mesial surface. The appendix is bent directly back on itself about one inch from its base.

When split open the mucous membrane distal to the angulation is seen to be black and gangrenous; the wall is very much thickened. The stricture at the point of angulation is almost complete.

Appendix (laboratory report).—Inflammation, necrosis, and fibrin.

Cultures (laboratory report).—Bacillus coli communis.

Present Condition of Patient (two years and eight months since operation).—September 16, 1903. Patient is out working. His wife says that he is in perfect health and up to his usual weight; he has no abdominal pain, is not constipated, and is not troubled with gas; the wound does not seem to bulge when he coughs or strains. He wears no belt. He is working steadily.

GENERAL SEPTIC PERITONITIS FROM APPENDICITIS WITH PERFORATION—APPENDICECTOMY—PERITONEAL FLUSHING—INTRA-INTESTINAL INJECTION OF MAGNESIA SULPHATE—DRAINAGE—RECOVERY.

Case III (surgical).—E. C.; aged thirteen; school-girl; United States; admitted to the Presbyterian Hospital March 19, 1901; discharged April 30, 1901, cured. Family history: Negative. Previous history: Has had measles and varicella. Eight months ago had an attack of severe abdominal pain with constipation and fever. The pain at first was general, then became localized to the right iliac fossa. There was vomiting and distention. She has been weak ever since this attack. Present trouble: Two days ago she was seized with general abdominal pain, nausea, and vomiting; the pain shifted to the right iliac fossa shortly. She was constipated.

Condition on Admission.—The child looks "sick"; tongue dry and coated. Thoracic viscera negative. All of the abdomen is held "rigid"; it is very tender; there is a mass in the right iliac fossa reaching across the middle line. The abdomen is tympanitic all over. Pulse, 132 and weak; temperature, 101° F. (rectal). Urine is negative.

Immediate Operation, March 19, 1901 (Gas and Ether).—Incision through right rectus. Free pus in general peritoneal cavity and many loose plaques of exudate; cultures made. The mass was not adherent to the anterior abdominal wall. It was made up of agglutinated intes-

tinal coils; the appendix was found pointing upward and toward the umbilicus, greatly swollen and perforated. Rapid appendicectomy and cauterization of stump. All of the intestines were of a deep red color and covered with flakes. Sponges passed above and below withdraw pus in large quantities. General peritoneal flushing by the method described. Intra-intestinal injection of one and a half ounces of magnesia sulphate. Gauze and rubber tissue cuff drainage. Abdomen sewed up hastily with through-and-through silk-worm gut sutures on account of patient's condition. Active stimulation was required as the patient was leaving the operating table and for the first twenty-four hours. Fowler's position for forty-eight hours. The bowels moved four times the first day. Drainage was left in for forty-eight hours. There was some nausea but no vomiting after the operation. Improvement was slow but gradual. A small collection of pus was detected in the wound on the ninth day and evacuated. On April 23 the patient sat up, and on April 30 she was discharged, the wound almost healed.

Appendix (operator's note).—The organ is of moderate size and seems much inflamed throughout. There are two perforations: one about its middle, the other at the tip. Its mesentery is thrombosed.

Appendix (laboratory report).—Abundant inflammatory infiltration with hemorrhage and necrosis at one portion.

Cultures (laboratory report).—Bacillus coli communis.

Present Condition of Patient (two years and six months after operation).—Seen by the writer September 21, 1903. She is in good health; she has to take an occasional dose of laxative medicine, and she has occasional crampy pains in the abdomen, but never bad enough for her to go to bed, or prevent her from doing her work about the house. She has gained much flesh since the operation. The abdominal scar is weak at its lower portion. It is not tender. Abdominal palpation is negative.

GENERAL SEPTIC PERITONITIS FROM APPENDICITIS WITH PERFORATION—APPENDICECTOMY—PERITONEAL FLUSHING—DRAINAGE—DEATH.

Case IV (surgical).—M. S.; aged thirty-one; married; housewife; United States; admitted to Presbyterian Hospital June 18, 1901; died June 19, 1901. Family history: Negative. Previous history: Negative. Menstrual history: Normal. Present trouble: Eight days ago

she was seized for the first time with severe pain in the right iliac region. There was vomiting, with fever and constipation. Three days ago the pain became distinctly less severe and she felt much more comfortable; gradually the pain returned and became general. Constipation was absolute. The abdomen has been distended and the fever high. She has had chilly feelings but no distinct chills.

Condition on Admission.—Patient looks very sick. Pulse is very weak—from 130 to 140. Temperature, 104.3° F.; respiration, 38. There is very marked general rigidity and tenderness, and the abdomen is much distended. No mass can be felt. It seemed a question whether she could stand any operative procedures, but her pulse responded somewhat to stimulation, and it was decided to offer to her what seemed her only chance.

Operation Immediate, June 18, 1901 (Gas and Ether).—Intravenous saline infusion in the early part of the operation; intermuscular incision; free pus in the general peritoneal cavity; no mass. Cultures made. Appendix was found to the mesial side of the caput coli pointing downward at first, then outward—deep purple, gangrenous, and perforated in two places. Rapid appendicectomy and cauterization of stump. Sponges passed above and below are withdrawn full of pus. General peritoneal flushing. One ounce of magnesia sulphate injected into the small intestine "high up." Sterile gauze and rubber tissue cuff drainage. Abundant abdominal dressing. Fowler's position on reaching the ward. Patient responded only moderately to liberal stimulation. During the next sixteen hours she passed gas freely by rectum. She did not vomit. Her temperature went up to 107.6 F.; pulse to 160; respiration to 48, and she died of sepsis about sixteen hours after her operation.

Appendix (operator's note).—The organ is five inches long, somewhat thickened, of a deep purple color. There is a concretion in it of the size of an ordinary bean. The mucous membrane seems inflamed. There are two spots of perforation: one at the junction with the caput coli, the other at about the middle of the organ.

Appendix (laboratory report).—Intense simple inflammation.

Cultures (laboratory report).—A mixture of several varieties of bacilli and large cocci, evidently putrefaction bacteria—a few small cocci, probably staphylococci pyogenes aureus.

GENERAL SEPTIC PERITONITIS FROM APPENDICITIS WITHOUT PERFORATION — APPENDICECTOMY — PERITONEAL FLUSHING — INTRA-INTESTINAL INJECTION OF MAGNESIA SULPHATE — DRAINAGE — RECOVERY.

Case V (surgical).—J. F.; aged twenty-two; single; electrician; England; admitted to Presbyterian Hospital May 31, 1901; discharged June 28, 1901, cured. Family history: Negative. Previous history: Measles and scarlet fever. He has been subject to "bilious attacks" for a number of years, but has never had any previous attacks of severe abdominal pain; has always enjoyed good health otherwise. Present trouble: Two days ago he was suddenly seized with severe abdominal pain, beginning in the lower part, then localizing itself in the right iliac region. He had a marked chill yesterday and to-day, of about an hour's duration, followed by high fever and profuse sweating. He has been much prostrated; constipation has been absolute; he vomited once yesterday. The pain and prostration have persisted.

Condition on Admission.—Patient is moderately nourished; he looks very "sick"; his tongue is dry and coated. The abdomen is held rigid all over, especially on the right side. Tenderness is general, especially marked over the appendix region; no mass can be felt. There is little or no distention. The abdomen is tympanitic all over except in the right flank, where there is dulness. On rectal examination there is tenderness anteriorly to the rectum, "high up." Pulse about 110; temperature not recorded. The urine shows a few casts.

Operation Immediate, May 31, 1901 (Gas and Ether).—Intermuscular incision. Free pus with foul odor in the general peritoneal cavity. Cultures made. The appendix was found to the outer side of the caput coli pointing upward toward the liver; gangrenous near its tip, where there were a few adhesions. Rapid appendicectomy and cauterization of the stump. Sponges passed above to the subhepatic and splenic areas and to the pelvis are withdrawn full of pus; lymph-flakes were seen scattered over the intestines. Peritoneal flushing followed by the intra-intestinal injection of magnesia sulphate (about two ounces). Gauze and rubber tissue cuff drainage to stump and to pelvis; a few catgut sutures (chromicized) to the external oblique and in the skin. Abundant sterilized gauze abdominal dressing.

The stimulation afforded by the peritoneal irrigation in this case was marked. Fowler's position on reaching the ward. The bowels moved during the next twenty-four hours, and afterward by means of cathartics. The wound discharge was free and of foul odor for forty-eight hours, and Fowler's position was continued during that time. The drains were removed the third day. The temperature and pulse-rate gradually subsided, reaching normal the end of the third day. The improvement in the patient's condition twenty-four hours after operation was very noticeable, and convalescence was uneventful. Subsequent urinary examinations were negative. This patient was discharged on June 28 with his wound healed.

Appendix (operator's note).—The organ is four to four and a half inches long and uniformly swollen. In its distal third is an area of gangrene about three-quarters inch in length, involving all the coats. When split open the mucous membrane is seen to be much inflamed, and there are two concretions, one large and one small, at the site of the gangrenous area.

Cultures (laboratory report).—A variety of bacillus coli communis and some colonies of cocci which form chains (streptococci).

Present Condition of Patient (two years and three months after operation).—Seen by the writer on September 23, 1903. This patient is in excellent general health and up to his usual weight. His appetite is good; he is not constipated. He has no abdominal pain whatsoever. As soon as he regained his strength after leaving the hospital he started to work, and he has been working steadily ever since. His scar is solid.

GENERAL SEPTIC PERITONITIS FROM APPENDICITIS WITH PERFORATION—APPENDICECTOMY—PERITONEAL FLUSHING—DRAINAGE—DEATH.

Case VI (surgical).—G. A.; aged twenty; single; postal clerk; admitted to the Presbyterian Hospital July 19, 1901; died July 19, 1901. Family history: Not recorded. Previous history: Always well till four days ago, when he began to feel sick. He was seized a few hours later with general abdominal pain and vomiting. The pain grew worse and localized itself in the right iliac region. There was constipation—no chill. The pain gradually became more general, but to-day ceased entirely and suddenly. He rode to the hospital, sitting up in a carriage.

Condition on Admission.—The patient looks extremely prostrated and septic; his hands and feet are cold; there is profuse sweating. The pulse is rapid and feeble; the temperature is not recorded. The abdomen is very rigid all over; there is general tenderness; it is hard to say whether the right side is more tender than the left; there is tympany all over except in the flanks, where there is dulness. The slightest chance only seemed to exist for this patient, but it was decided to offer this to him.

Operation Immediate, July 19, 1901 (Gas and Ether).—Median incision; free pus in the general peritoneal cavity, under great tension, the fluid squirting up two feet or more in the air as soon as the cavity was opened. The appendix was found glued down to the pelvic wall in the concavity of the sacrum, bathed in pus, gangrenous throughout and perforated near its base. Rapid appendicectomy and cauterization of the stump. Long clamps were left on the stump and mesentery on account of their deep situation and the patient's condition. Sponges passed to subhepatic, splenic, and pelvic areas were withdrawn full of pus. Peritoneal flushing. Gauze and rubber tissue, drainage. Patient had to be infused during the operation. Fowler's position on reaching the ward. His pulse and general condition improved somewhat under free stimulation, but later on he became weaker, and died about five hours after the operation.

Appendix (operator's note).—The organ is a large one; its distal half is markedly clubbed and gangrenous. There is a spot of perforation about one-half inch from its base.

Appendix (laboratory report).—Intense inflammation, with hemorrhage and necrosis.

Cultures (laboratory report).—Mostly bacillus coli communis.

GENERAL SEPTIC PERITONITIS FROM APPENDICITIS WITH PERFORATION—APPENDICECTOMY—PERITONEAL FLUSHING—DRAINAGE—RECOVERY.

Case VII (surgical).—D. M.; aged thirty-two; single; picture-framer; Hungary; admitted to the Presbyterian Hospital October 21, 1902; discharged November 11, 1902, cured. Family history: Negative. Previous history: Several attacks of specific urethritis. Two years ago he had apparently an attack of appendicitis which lasted one week.

He had pain in the right iliac fossa with tenderness (there was constipation, but no vomiting). Some tenderness has remained there ever since. He is habitually constipated. Present trouble: Four days ago he began to have pain in the lower part of the abdomen, especially marked on the right side. He had vomiting and fever. The next day the abdomen was quite tender. In the last two days the pain and tenderness have become much more marked and he has felt much more sick. He has vomited once, and his bowels have been obstinately constipated. He has had no chill. Large doses of morphine given to him by his physician have failed to relieve the pain.

Condition on Admission.—Patient is fairly well nourished; mucous membranes pale; his expression is "anxious"; he looks markedly septic. Temperature, 105.4°; pulse, 120 and weak. The abdomen is held rigid all over, the right rectus more so than the left. There is general tenderness, marked in the right iliac fossa. The abdomen is much distended, and there is tympany everywhere except in the right iliac fossa, where there is a mass somewhat dull to percussion.

Operation Immediate, October 21, 1902 (Gas and Ether).—Intermuscular incision on the right side. Free pus and many flakes in the general peritoneal cavity. Cultures made. The mass was not adherent to the parietal peritoneum. It was made up of agglutinated coils of intestine. The appendix was found pointing inward toward the umbilicus and somewhat upward, much inflamed and covered by a few adhesions; there was a spot of perforation about one-quarter inch from its base. The mesentery contained pus in its tissue. Rapid appendicectomy. Sponges passed upward to the subhepatic and splenic areas and down into the pelvis are withdrawn full of pus. General peritoneal flushing. Patient's condition was so poor that it was decided to omit the intra-intestinal injection. Gauze and rubber tissue cuff drainage. One chromicized catgut suture to the upper part of the external oblique muscle and the skin partially approximated with silk. Copious sterilized gauze abdominal dressing. The patient had to be freely stimulated during the operation. Fowler's position on reaching the ward, and for forty-eight hours afterward. For seventy-two hours after the operation the abdominal distention was considerable and vomiting frequent, the temperature being 102° to 103° F. much of the time, and the pulse about 110. He seemed, however, to be improving.

The bowels were moved on the third day. Temperature and pulse-rate reached normal on the ninth day. The pelvic drain was removed in forty-eight hours, the other a day later. The discharge from the wound after that was slight. He was allowed up on November 7, and left the hospital on November 11, 1902, with a small granulating sinus.

Appendix (operator's note).—The organ is intensely inflamed, red, glistening, and "angry looking," about three and a half inches long. There is a spot of perforation about one-quarter inch from its base. When split open the mucous membrane is seen to be greenish and gangrenous throughout.

Appendix (laboratory report).—Intense inflammatory infiltration of the wall.

Cultures (laboratory report).—Bacillus communis.

Leucocyte Count.—October 22, 1902, 15,000 (after operation). October 23, 13,000 (second day after operation). October 25, 13,000 (fourth day after operation).

Present Condition of Patient (eleven months after operation).—When the writer called, on September 16, 1903, the patient was out making arrangements for his wedding the next day. His sister, who has been living with him since he left the hospital, said that for the first six months after he got home he had a few hours of abdominal pain, at infrequent intervals, but none since then. He is not constipated. She has seen the scar lately and she thinks that there is no bulging.

GENERAL SEPTIC PERITONITIS FROM APPENDICITIS WITH PERFORATION—APPENDICECTOMY — PERITONEAL FLUSHING — INTRA-INTESTINAL INJECTION OF MAGNESIA SULPHATE—DRAINAGE—RECOVERY.

Case VIII (surgical).—W. B. Van I.; aged thirty-four; artist; United States; admitted to Presbyterian Hospital February 14, 1903; discharged March 21, 1903, cured. Family history: Negative. Previous history: One year ago had an attack of rheumatism; otherwise perfectly healthy. Bowels are usually loose. Present trouble: Six days ago he was suddenly seized with abdominal pain of crampy character, at first general, then localized to the right iliac fossa. He was constipated. Three days later vomiting started in, and has continued

up to the present time. For the last two days his pain has been very severe, and his physician has given him large doses of morphine.

Condition on Admission.—Patient is poorly nourished; he looks very "sick." The abdomen is rigid all over and very much distended, tenderness is general, and it is difficult to decide what is the most tender part. No mass can be felt in the right iliac fossa. All the abdomen is tympanitic except the flanks, where there is dulness. Patient is hiccoughing continuously, and is vomiting frequently a foul-smelling fluid, almost fecal. His pulse is poor—about 120. Temperature not recorded. Urine shows a few casts.

Immediate Operation, February 14, 1903 (Gas and Ether).—Peritoneum opened through intermuscular incision on right side; free pus in the general peritoneal cavity; cultures made. Intestines are all injected and very much distended; there are a few adhesions that bind the appendix down; its tip points downward toward the pelvis; there is a perforation in the outer third, and an angulation about the middle. Rapid appendicectomy and cauterization of stump. Sponges passed to the subhepatic and splenic regions are withdrawn full of pus; pelvis is also full of pus. General peritoneal flushing. Intra-intestinal injection of two ounces of magnesia sulphate. Gauze with rubber tissue cuff drainage to pelvis, to stump, and above. Peritoneum united above with catgut; a few chromicized catgut sutures to the muscles and a few silk sutures for the skin. Abundant sterilized gauze abdominal dressing. Patient put up in Fowler's position on reaching the ward. He was in poor condition and required active stimulation for several days. He vomited foul-smelling material at frequent intervals for the first twenty-four to thirty-six hours. Repeated lavage relieved the condition somewhat. In the first twenty-four hours he had two movements. Abdominal distention was extreme, but quantities of gas were passed through the rectal tube, after the application of turpentine stupes; for several days there was restlessness and delirium. For the first few days the hiccoughing was persistent and very distressing; it subsided somewhat after each lavage, and disappeared by the seventh day. The temperature gradually fell to normal during the first week, but there were irregular rises to 100° and 101.2° F. several times during the next ten days. The pulse-rate remained in the neighborhood of 80 most of the time after the operation. The urine became normal

in a few days. The drains were removed after forty-eight hours. On March 3 (seventeen days after the operation) the edges of the abdominal wound were found to gape somewhat (due evidently to the previous excessive abdominal distention), and a secondary suturing was done under cocaine. March 7 he sat up in bed. March 21, 1903, he left the hospital. He was sleeping well, his appetite was excellent, and he was able to walk around with a little help. His wound was healed.

Appendix (operator's note).—The organ is very much inflamed and angulated about its middle; there is a perforation in its distal third. When split open the mucous membrane is seen to be thick, dark, and velvety; its distal half is green in color, and sloughing.

Appendix (laboratory report).—Intense inflammatory infiltration of the wall.

Cultures (laboratory report).—These have evidently been contaminated.

Leucocyte Count.—Before operation, 7,500. After operation, 4,500 (first day). 5,000 (second day). 8,100 (third day).

Present Condition of Patient (seven and one-half months after operation).—Patient was seen by the writer September 23, 1903, and found in excellent health and at work. With the exception of a few twinges he has had no abdominal pain since he left the hospital. His appetite is excellent. He has regained his normal weight; he needs no laxatives, having two to three small movements a day, as was his former habit. There is a slight bulging at the inner side of the scar; he is wearing a light truss for this.

GENERAL SEPTIC PERITONITIS FROM APPENDICITIS WITH PERFORATION—APPENDICECTOMY — PERITONEAL FLUSHING — INTRA-INTESTINAL INJECTION OF MAGNESIA SULPHATE—DRAINAGE—RECOVERY.

Case IX (surgical).—E. *Z.*; aged fifteen; single; button-maker; United States (?) ; admitted to the Presbyterian Hospital February 19, 1903; discharged April 5, 1903, cured. Family history: Negative. Previous history: Measles and whooping-cough; otherwise healthy. Present trouble: Nine days ago she was seized with moderately severe crampy pains in the abdomen; these continued on and off without any constipation until three days ago, when she awoke during the night in great pain, which was felt all over the abdomen. She vomited

repeatedly, and her bowels moved only slightly with enemata. She had much fever and chilly sensations, but no chill. She was much prostrated. She was treated with absolute rest and rectal feeding only for about two days with slight improvement, but to-day she feels much sicker.

When First Seen by the Writer her Condition was as follows: She looks very sick; eyes sunken, tongue dry and heavily coated. Pulse rapid, of fair force. Breathing almost entirely thoracic. Lungs negative. The abdomen is rigid all over and there is marked tenderness everywhere; the region of the right iliac fossa is exquisitely tender. Distention is moderate; no mass felt. The abdomen is tympanitic except in the flanks, where there is dulness. The urine contains many hyaline and granular casts.

Operation Immediate, February 21, 1903 (Gas and Ether).—Intermuscular incision on right side. Free pus with very foul odor found in the general peritoneal cavity. Cultures taken. Appendix found pointing downward toward the pelvis, much inflamed and with a perforation at its base. The mesentery was also suppurating. Rapid appendicectomy and cauterization of the stump. The whole mesoappendix was removed. The intestines were much distended, congested, and covered with flakes. Sponges passed above to subhepatic and to splenic regions and to pelvis are withdrawn soaked with pus. General peritoneal flushing. Loop of distended small intestine brought down and injected with two ounces of magnesia sulphate. Gauze and rubber tissue cuff drainage to stump and to pelvis. Copious sterilized gauze abdominal dressing. Patient put up in Fowler's position on reaching the ward. She required stimulation during the operation, and for the first twenty-four hours after the operation. Within a few hours she had a large fecal movement, and for several days after this the bowels moved regularly with enemata, later of themselves. Drainage was free and of foul odor. The drains were changed after forty-eight hours. The temperature gradually declined and reached normal on the sixth day. Her condition slowly improved. On the sixteenth day after operation a mass was felt in the left iliac fossa. This disappeared in a few days under catharsis. Her urine gradually cleared up. She left the hospital April 5, 1903, with a small sinus. She was in good general condition.

Appendix (operator's note).—The organ is very much inflamed;

it and the mesentery are actively suppurating. There is a perforation at the base of the appendix close to the caput coli scarcely leaving room for a good stump.

Appendix (laboratory report).—Intense inflammatory infiltration; there is a mass of pus cells in the lumen; the mesentery is also intensely inflamed.

Cultures (laboratory report).—Bacillus coli communis.

Leucocyte Count.—Before operation, February 20, 14,000. After operation, February 21, 12,500 (first day). February 22, 16,000 (second day). March 10, 24,000 (eighteenth day). March 21, 18,000 (twenty-ninth day).

Present Condition of Patient (five months after operation).—Seen by the writer September 21, 1903, in the button factory where she is working. She looks fairly well. She says she has an excellent appetite and that she is not constipated. Occasionally she has some epigastric pain which reaches up to her throat after meals. She is working steadily now and has only lost two days in the last month. She has not menstruated. There is a very slight bulging in the lower angle of the scar. The rest is firm. Abdominal palpation is negative.

GENERAL SEPTIC PERITONITIS FROM APPENDICITIS WITH PERFORATION—APPENDICECTOMY—PERITONEAL FLUSHING—DRAINAGE—RECOVERY.

Case X (surgical).—P. McF.; aged thirty-seven; married; claim-adjuster; Ireland; admitted to the Presbyterian Hospital May 5, 1903; discharged May 30, 1903, cured. Family history: Negative. Previous history: A distinct alcoholic habit. Since he has grown up he has had once or twice a year attacks of "stomach trouble" associated with vomiting, fever (?), and constipation. The attacks have lasted for two weeks or more; there have usually been pain and tenderness in the epigastrium. For the last year and a half (since he has been married) he has been free from these attacks. Present trouble: Five days ago he was seized with general abdominal pain and constipation. These persisted, and three days ago the pain became much worse and was localized in the right iliac region and in the lower abdomen. His abdomen became very tender, and he vomited on and off. There has been absolute constipation. He has been much prostrated.

Condition on Admission.—Patient looks distinctly "sick" and "septic." The abdomen is markedly rigid all over, especially in the right iliac region. The whole abdomen is extremely tender. Distention is marked. There is tympany everywhere except in the flanks, where there is dulness. On the right side this is continuous with the liver dulness. No mass can be felt. Temperature, 102° F.; pulse, 100 and weak; respiration, 28, thoracic. The urine contains a trace of albumin and a few hyaline and granular casts.

Operation Immediate, May 5, 1903 (Gas and Ether).—Intermuscular incision on the right side. The peritoneal cavity is found full of yellowish and sticky pus; no adhesions. Cultures made. Appendix found below the caput coli pointing inward and somewhat upward—large, of a brilliant red color, covered with lymph exudate and presenting near the middle a perforation with greenish sloughing edges. The mesentery is heavy, brittle and suppurating. Rapid appendicectomy and cauterization of stump. The intestines were all markedly injected. A portion of the omentum was seen (in the appendical region) almost gangrenous; this portion was rapidly resected. Sponges passed above to the subhepatic and splenic regions and down to the pelvis withdraw the same kind of yellowish and sticky pus. There seem to be no free flakes. General peritoneal flushing. Gauze and rubber tissue cuff drainage. Peritoneal incision narrowed somewhat with a catgut suture and the muscles with a few chromicized sutures; skin with silk. Copious sterilized gauze dressing. The stimulation afforded by the hot peritoneal flushing in this case was marked. Patient put up in Fowler's position on reaching the ward. This was kept up for forty-eight hours. There was some vomiting for the first few days and much hiccoughing. Lavage gave considerable relief. The bowels moved with cathartics on the third day, and after that fairly regularly. The drains were removed on the third day and smaller ones substituted. The pulse-rate and the temperature gradually declined, reaching normal on the seventh day. His convalescence was unusually rapid. On May 22 he sat up in bed, and on May 30 he left the hospital with a small sinus about one inch deep.

Appendix (operator's note).—The organ is an enormous one. It is about four inches long and about three inches in circumference; it is of a bright red or vermilion color, and there are lymph-flakes scattered

over it. There is a perforation on its convex border about one-quarter to one-half inch in diameter, with gangrenous edges. The mesentery is about one inch thick, œdematous. Pus can be squeezed out of its meshes. When split open, the mucous membrane is seen to be greenish-black throughout its whole extent; the perforation is funnel-shaped, the smaller opening in the mucous membrane. There is a pasty fecal concretion about the middle of the proximal half of the organ. The wall of the appendix is about one inch thick. It is œdematous, and there are hemorrhages apparently in the submucosa.

Appendix (laboratory report).—Purulent inflammation; extensive infiltration of all layers along much of the course of the appendix.

Cultures (laboratory report).—This report cannot be found. The tubes were probably not sent over to the laboratory.

Leucocyte Count.—May 6, 1903, 13,800 (first day after operation). May 8, 1903, 9,100 (third day after operation).

Present Condition of Patient (four and one-half months after operation).—Patient was out attending to his business when the writer called, September 23, 1903. His wife says that he started to do his work a few weeks after leaving the hospital, and that he has been working steadily ever since; that his appetite is excellent; that he is gaining in weight. He has to take a laxative occasionally when he has indulged a little too freely in alcoholic beverages. His scar is still a little tender to the touch, but there is no bulging of it, and there is no pain in it.

GENERAL SEPTIC PERITONITIS FROM APPENDICITIS WITHOUT PERFORATION — APPENDICECTOMY — PERITONEAL FLUSHING — DRAINAGE —RECOVERY.

Case XI (surgical).—H. B.; aged nineteen; single; Denmark; admitted to Presbyterian Hospital June 3, 1903; discharged July 7, 1903, cured. Family history: Negative. Previous history: Measles, croup, rheumatism; has had occasional attacks of epigastric pain after meals, with vomiting; four such attacks during the last year. She is habitually constipated. Present trouble: Two weeks ago seized for the first time with abdominal pain on the right side. She felt sick and went to bed. She vomited several times and had some fever. Bowels were constipated. Since then the pain has persisted and for the last few

days has been felt all over the abdomen. Bowels could not be moved. She has gotten very weak. She was brought into hospital by ambulance.

Condition on Admission.—Patient is muscular and well nourished; she looks "sick." Temperature, 103°; pulse, 100. Chest: Negative. Abdomen: Both recti are distinctly rigid, the right more than the left, the middle portion of the right rectus the most. There is general abdominal tenderness, most marked on the right side and "high up." Distention is moderate, tympany all over; there is no dulness in the flanks. Breathing is almost entirely thoracic. Vaginal examination: Negative.

Operation—as soon as patient's consent was obtained, about two hours after admission—*June* 3, 1903 (Gas and Ether).—Incision at the outer edge of the right rectus muscle. Free pus in the general peritoneal cavity; cultures made. The caput coli was placed "high up"; the appendix was found pointing inward and upward; it was markedly inflamed and bathed in pus; there were no adhesions. The mesentery was very short, making the appendicectomy a little more difficult than usual, for it held the tip down tightly. The intestines were injected and moderately distended. Sponges passed to subhepatic and splenic regions and to pelvis were withdrawn with a drachm or more of pus in each case; there seemed to be more pus above than in the pelvis, apparently on account of the situation of the appendix. General peritoneal flushing—the patient's condition was so poor that the intraintestinal injection was omitted. Gauze and rubber tissue cuff drains inserted. The muscular edges of the wound were partially approximated with chromicized catgut; silk for the skin. The patient required active stimulation on the operating table, and for twenty-four hours afterward. Fowler's position on reaching the ward, and for the next forty-eight hours. At the end of thirty-six hours the patient looked decidedly better. Vomiting was infrequent; the bowels moved on the third day with cathartics, and after that fairly regularly with enemata. Drainage removed in forty-eight hours. Convalescence was uninterrupted. She sat up in bed on July 1, and on July 7 she left the hospital; the wound was then only a small granulating spot.

Appendix (operator's note).—The organ is a small one, about three inches long. The peritoneal coat is very succulent; the rest of the appendix feels very firm. When slit open, the contents are seen

to consist of bloody mucus; there are a number of areas of hemorrhage scattered throughout the mucous membrane.

Appendix (laboratory report).—Acute inflammatory infiltration; some connective-tissue thickening, apparently of older date.

Cultures (laboratory report).—No growth.

Leucocyte Count.—June 13, 1903, 20,300 (before operation). June 14, 1903, 13,450 (day after operation). June 15, 9,000 (two days after operation).

Present Condition of Patient (three and one-half months since operation).—She lives forty miles out of town and cannot conveniently come in at present. She reports by letter, September 25, as follows: She is in good health and has an excellent appetite; she is constipated, as before her attack. She has occasionally some abdominal pain, with the formation of gas. She says the scar is firm, with no bulging.

VII.

A CASE OF GENERAL STREPTOTHRIX INFECTION; WITH A STUDY OF THE MICRO-ORGANISM.

By George A. Tuttle, M.D.

The case which furnished the material for this report was treated in the Presbyterian Hospital in the summer of 1898.

The patient was a woman thirty-three years of age. She was of German parentage, but had lived in Burmah. Her family history was negative. Excepting the common diseases of childhood, her health was always good.

Six days before her admission to the hospital her illness began with a severe chill, and fever, and pain in her left side and back. The following day the pain in the side was worse and breathing was difficult. She began to cough and had some expectoration, but no blood was noticed in the sputa. At irregular intervals she had alternating hot and chilly sensations. There was loss of appetite, and constipation. Restlessness, weakness, and prostration were the only other symptoms noted in the history.

On admission, the patient complained of pain in the left side of the chest, cough, fever, weakness and prostration. Her temperature was 103° F., and her pulse and respirations were rapid.

Physical Examination.—The patient is poorly nourished and anæmic. Her tongue is moist and is slightly coated. Heart: The apex is in the fifth intercostal space, three and one-half inches to the left of the median line. The action is regular and of fair force. There is slight roughening of the first sound at the apex and accentuation of the pulmonic second sound. No murmurs are heard. The pulse is soft, regular, and of moderate force. The arterial tension is not increased. Lungs: Anteriorly the right lung is normal. On the left side over an area two inches by three inches just to the left of the nipple there is marked dulness to percussion, and bronchial voice and breath-

ing. No râles are heard. Posteriorly, the left lung is normal. At the extreme base of the right lung there is slight dulness and diminished breathing, with crepitant râles after coughing. The voice is normal. Liver: The dulness extends from the fifth intercostal space to the margin of the ribs. The edge is not felt. Spleen: The area of dulness is increased. The edge cannot be felt. The abdomen is soft and the tympany is somewhat increased. There is no tenderness and nothing abnormal is felt. The extremities are normal. Examination of the urine showed nothing abnormal.

The history of the disease and the physical signs indicated an attack of acute lobar pneumonia, the area of consolidation being small and situated in the lower part of the left upper lobe in front. Frequent and violent coughing, with almost no expectoration, pain in the affected side and in the lumbar region, restlessness and sleeplessness, and involuntary urination were the symptoms noted during the first four days in the hospital. The pneumonic area increased somewhat, and extended backward to the posterior axillary line, and the temperature was continuous at 103° to 103.5° F. On the fifth day the temperature fell two degrees, and signs of resolution appeared in the consolidated area. The apparent improvement, however, was of short duration. On the sixth day the temperature rose to 104.5° F., and continued to rise each day, reaching 107.5° F. shortly before death, which occurred on the ninth day in the hospital and the fifteenth day of the disease. During the last four days the patient complained bitterly of pain in the lumbar region and in the thighs and legs, and of intense vesical tenesmus. The stools and urine were passed involuntarily. Signs of consolidation were found in the right lower lobe, behind. There were repeated attacks of profuse sweating. On the day before her death three indurated swellings beneath the skin were noticed. One, on the left forearm, about the size of a walnut, apparently contained pus. Two, of smaller size, were situated in the right groin.

Blood-cultures from a vein in the arm, taken on the sixth day, remained sterile. Subsequent attempts failed on account of the feeble circulation. The leucocyte count on the seventh day was 36,000.

Autopsy.—Nine hours post mortem. The frame is of medium size and in good muscular condition. The subcutaneous fat is scant. On the right arm, the left forearm, the abdominal wall, and on both thighs

there are eight or ten slightly projecting, rounded, fluctuating, subcutaneous swellings from one-half inch to one inch in diameter. The skin over most of these nodules is unaltered, but over the larger ones there is a slight bluish discoloration. They are found to be collections

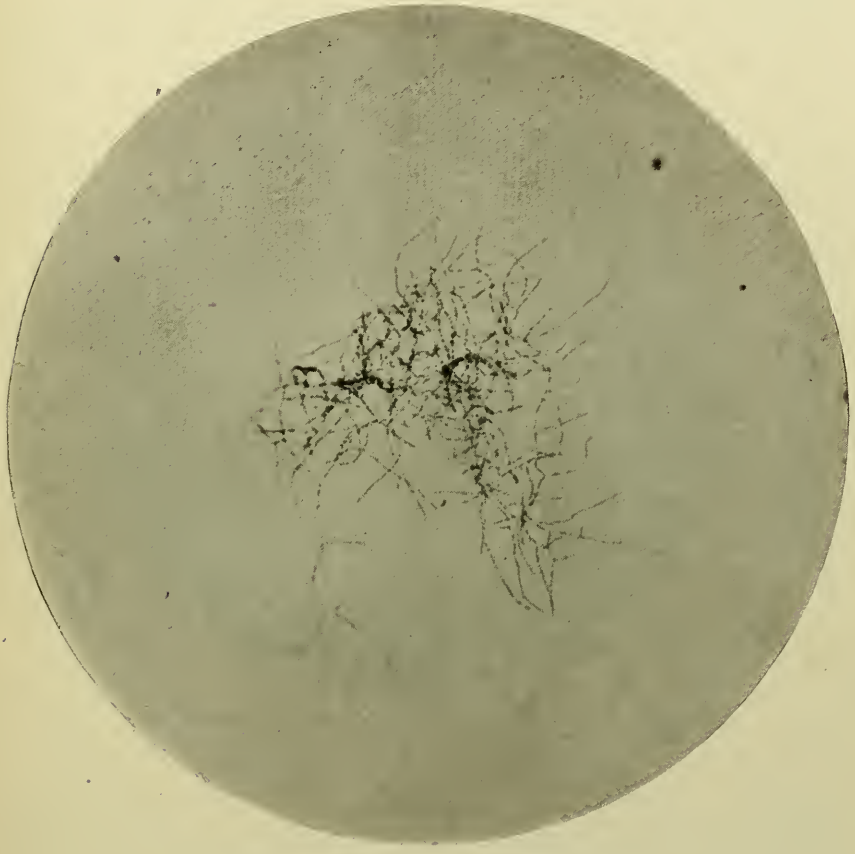

FIG. 1.—Streptothrix from bouillon culture.

of bluish-gray, thick, mucilaginous matter, which is very tenacious and can be drawn out into long threads. The pericardium is normal. The heart weighs nine and one-half ounces. The valves are normal. Just underneath the mitral valve, in the ventricle, is a thrombus of fibrin adhering to the endocardium, and scattered through it are softened

and apparently suppurating foci of a whitish color. In the wall of the right ventricle are several small white areas which look like septic infarctions, and one of larger size in the wall of the left ventricle corresponds with the position of the thrombus, and apparently was the exciting cause of it. Left lung: There are old pleuritic adhesions in front. In the lower part of the upper lobe is an area of consolidation, gray in

FIG. 2.—Young streptothrix threads showing terminal buds.

color and partly resolved. Scattered through this area and through the rest of the lung are small foci of pus. Right lung: There are a few recent pleuritic adhesions. The lower lobe is thickly studded with miliary tubercles, and scattered through the entire lung are suppurating foci like those in the left lung. At the lower border of the lower lobe there is a cheesy nodule which suggests an old tubercular lesion. Liver: There is nothing abnormal, excepting that the color is pale. The spleen is normal. Pancreas: In and immediately around the gland there are many small abscesses. Kidneys: The description of one applies to

both. The capsule is not adherent. The surface is everywhere and evenly dotted with minute white spots which suggest septic emboli rather than tubercles. They are very slightly raised above the surface and are so close together that the surface of the kidney is decidedly gray and finely granular. A few prominent white nodules, from one-quarter inch to one-half inch in diameter, contain thick, tenacious matter. Section shows that the entire substance of the kidney is densely studded with these minute white granules. The ureters and suprarenal bodies appear to be normal. The mesentery in places is thickly sown with miliary tubercles, and many are seen on the parietal and intestinal peritoneum. Some of the mesenteric lymph-nodes show foci of suppuration. Plants from the kidneys were made upon six tubes of Löffler blood-serum.

The gross pathological conditions were interpreted as follows: An old tubercular nodule in the right lung; acute miliary tuberculosis of the right lung and peritoneum; acute lobar pneumonia, affecting the left lung; septic infarctions and pyæmic abscesses of both lungs, heart muscle, both kidneys, pancreas, mesenteric lymph-nodes, and subcutaneous connective tissue. The miliary tubercles of the right lung and peritoneum presented the characteristic appearance of genuine tuberculosis. They were minute, hard, gray, almost translucent nodules, while the granules in the kidneys were of an opaque-white or yellowish-white color.

Microscopical Examination.—Smears from the abscesses beneath the skin and on the surface of the kidneys were stained with methyl blue, carbol-fuchsin, and by Gram's method. The smears resemble those made of tenacious sputum. There is a large amount of mucoid material containing a considerable number of leucocytes. Occasionally irregularly curved, thread-shaped micro-organisms are found. They vary considerably in length and thickness, and broken and apparently degenerating fragments are seen. The more slender threads are evenly stained, but some fragmentation or beading of the protoplasm can generally be observed. The thicker threads and broken fragments show deeply stained globules and irregular bodies in a faintly visible rod or thread-shaped covering. Some branching threads are observed, but more commonly they are not branching. The fragments seen in the smears, varying in length and thickness and staining properties,

convey the impression of a branching organism, the slender, more evenly stained threads being the younger branches, and the thicker, broken, and granular fragments the parent trunks. No other micro-organisms are found in the smears. Sections from the lower lobe of the right lung, stained with hæmatoxylin and eosin, showed in certain places the identical microscopical appearances which are considered characteristic of tuberculosis. There are distinct tubercles, of recent growth, consisting of epithelioid cells and giant cells. Others have granular or cheesy centres with epithelioid cells and giant cells at the periphery; and some consist of cicatricial connective tissue surrounded by a zone of epithelioid cells containing giant cells. Some of the tubercles are situated in the walls of bronchi and project into their lumina. There are also irregular areas of cicatrical connective tissue. Many of the tubercles are surrounded by zones of small round cells and leucocytes, and many foci of similar cells are scattered through the sections. The air-spaces are irregularly dilated. Some of them contain a few desquamated cells, while others are filled with leucocytes. Some sections show a diffuse infiltration of leucocytes and small cells, and the air-spaces and bronchi are crowded with leucocytes. In places, also, the process has gone on to an actual breaking down of the lung tissue and the formation of small abscesses. The microscopical examination of this lung seemed to confirm the diagnosis made at the autopsy of an acute miliary tuberculosis starting from an old tuberculous lesion in the lower lobe. Sections from the left lung presented the characteristic picture of acute lobar pneumonia, with foci of leucocytes and small cells and many small abscesses scattered through the rest of the lung. Nothing distinctly tuberculous was found in any of the sections. Many sections from the right lung showing the tuberculous lesions were stained in the usual way for tubercle bacilli. Most careful searching by a number of competent examiners failed to discover any tubercle bacilli or any other micro-organisms. Stained by Gram's method, with care not to decolorize too completely, threads like those described in the abscesses are found in great abundance, but rather faintly stained. No threads can be found within the typical tubercles with giant cells, but in the zones of small cells around them they are seen in great numbers, winding about among the cells and forming a sort of network. In the minute foci of small cells one or two fragments of threads are generally seen,

and a moderate number in the small abscesses. In the areas of more diffuse infiltration these threads are abundant. No other micro-organisms can be found except in the pneumonic area of the left lung, where some groups of cocci are seen. The thread-like organisms are also found in this area and in the other foci scattered through the lung.

The staining methods described by Flexner were found to give the best results. The most reliable and the one requiring the least time

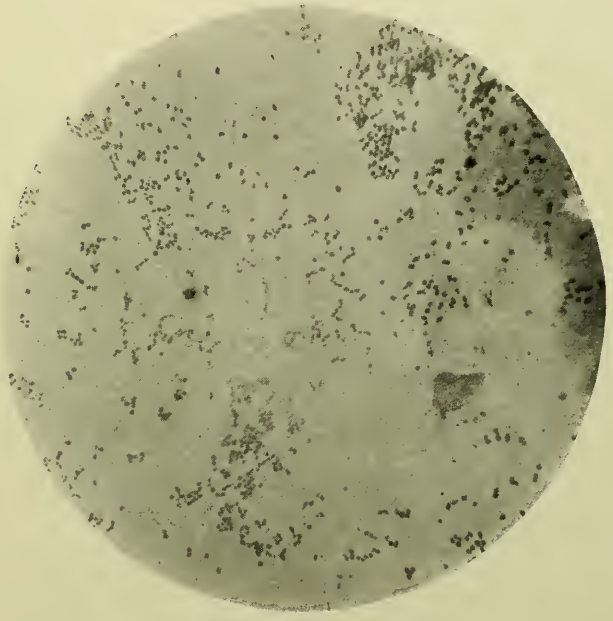

FIG. 3.—Streptothrix Spores.

is a modified Gram's method. The sections stained with aniline-gentian violet are dipped for a short time in a diluted Gram's iodine solution and then treated with aniline oil until sufficient color has been removed. The aniline oil is then washed out with xylol, and the section is mounted in xylol balsam. The other method mentioned by Flexner was found to be less reliable, but gave more beautiful results when successful. The specimens are first stained with dilute hæmatoxylin solution to bring out the nuclei of the cells and then are stained with carbol-fuchsin and decolorized with aniline oil as before. Long staining

with carbol-fuchsin and careful treatment with aniline oil are necessary for success. Many times the micro-organisms were completely decolorized by this method, but when successful, the dark-red threads winding among the bluish nuclei produced a striking picture.

Sections of the infarctions in the walls of the ventricles of the heart showed a breaking down of the muscle and a collection of leucocytes, while the surrounding tissue was infiltrated with leucocytes and small round cells. The branching threads, like those previously described, were found in considerable numbers.

Sections of the kidneys show an abundance of little rounded tubercles, composed of small cells, many of them degenerated and granular in the centre, but no giant cells are found. Some of the tubercles contain a dense network of the branching threads, while in others only a few fragments of threads can be seen. In places the threads are seen growing out from the circumference of a tubercle and winding about among the normal kidney cells, close by.

Of all the sections of the different organs examined, those from the pneumonic area in the left lung were the only ones in which bacteria other than the threads were found. These were a variety of cocci which were not obtained in cultures.

Culture Experiments.—Six tubes of Löffler blood-serum were inoculated from the kidneys. These organs were selected as most likely to show uncontaminated the micro-organism which caused the general infection. The cut surface was thoroughly seared with a red-hot iron, and a platinum wire of large size was plunged through this surface into the cortical portion of the kidney parallel with the outer surface, care being taken to avoid approaching either the outer surface or the calices. The wire was then rubbed thoroughly over the surface of the culture medium to separate the material as much as possible. The tubes were placed in the incubator. On the third day after inoculation, minute white colonies appeared in some of the tubes, and on the fifth day all the tubes showed from three to ten or twelve similar colonies in each. The colonies increased in size until some of them reached a diameter of one-eighth of an inch, but most of them were smaller. The color, at first white, changed to yellowish-white and then to a decided pale yellow. Having attained a certain size at the base, the colonies ceased to extend, but became more and more prominent. The growth was

FIG. 4.—A streptothrix tubercle in lung. Original case.

apparently more rapid at the periphery, and the fully developed colony was round, with convex sides and with a cup-shaded depression at the top. The height of the colony was sometimes greater and sometimes less than the diameter of the base. The well-developed colonies cling firmly to the surface of the medium and are not easily detached or broken up. The growths in all of the tubes were absolutely pure, and consisted of branching threads like those found in the sections. A more minute description of these organisms will be given below.

Transplants on Löffler blood-serum produce a pale sulphur-yellow growth, forming a layer with a slightly irregular and wrinkled surface and prominent edges where the growth continues longest. The color remains the same until the medium dries, when it becomes white. The growth clings so tenaciously to the surface of the medium that in removing a specimen for examination a portion of the blood-serum also is torn away.

Löffler blood-serum seems to be the most suitable medium for cultures. The growth on this medium is more rapid and abundant than on any of the other media tried.

On plain agar and glycerine agar the growth is the same as on blood-serum, but is less rapidly developed.

Stab cultures in gelatine grow only at the surface. No liquefaction is produced. A light yellow layer of moderate extent, never reaching the sides of the tube, is formed, and the color gradually deepens until an orange-yellow shade is reached.

In bouillon the growth is slow and takes place only at the surface and on the sides of the tube. The bouillon remains perfectly clear and no pellicle or scum develops on the surface. If the tube is not disturbed or jarred, minute white tufts are seen clinging to the surface of the glass. But if the tube is shaken even slightly they sink slowly to the bottom, forming a white, fluffy layer. These growths when undisturbed resemble minute balls of thistle-down. The yellow color is not apparent even in the mass at the bottom of the tube.

In milk the growth is similar to that in bouillon, but when there is a layer of cream on the surface it becomes decidedly yellow. The milk is not coagulated. In glucose bouillon no gas is formed. On potato the growth is rapid and assumes a much deeper color, passing through orange-yellow to a brick-red or almost a seal-red. Then as it becomes dry

it is almost snowy white around the edges, and at times the entire growth appears to be covered more or less completely with a fine white powder. The red color develops rapidly, and growth apparently ceases earlier than on blood-serum or agar.

The temperature limits of growth were not accurately determined. It grows most rapidly and abundantly at blood-temperature; but in summer it grows almost equally as well at the temperature of the air. In winter no growth, or at most very slight growth, takes place even at room temperature.

It is strictly aerobic. In sealed tubes a very scant growth is obtained, but when deprived of oxygen absolutely no growth can be detected, although life is preserved for long periods. Cultures from a tube kept for two months without oxygen, and showing no sign of growth, developed rapidly when exposed to the air.

Morphology.—The relative thickness of the threads varies somewhat in different parts of the same individual branching organism and considerably in specimens taken from different culture media. If the growth is rapid and luxuriant, the threads are thicker than in specimens taken from growths on less suitable media. For instance, when grown on blood-serum the threads are comparatively thick and coarse, but those growing in bouillon are very slender and delicate. The main trunk also is often thicker than the branches. When unstained they are homogeneous gray threads, without any appearance of a central canal or double contoured wall. There is never any segmentation of the threads. When properly stained there is always a distinct beading or fragmentation of the protoplasm, but overstaining with fuchsin produces rather coarse, evenly red rods. The branching is irregular and without symmetry, and the branches are placed at a wide angle, very nearly, and sometimes quite, at right angles. This is best seen in specimens taken from liquid media. The irregularly stellate arrangement of the branches, which was observed by Eppinger in his original specimen, is often seen in young organisms floated out from a liquid medium. Eppinger considered this form sufficiently characteristic to warrant the term asteroides to distinguish the species. But terms like asteroides and arborescens do not sufficiently distinguish the species of a genus which is characterized by more or less tree-like branching, and so far no satisfactory nomenclature has been adopted.

Spore Formation.—On examining the deep orange or red-colored growth upon potato, one is surprised to find that the threads have entirely disappeared, and that the specimen consists of moderately large cocci. In very young cultures upon potato both threads and cocci are found, but the relation between them cannot be seen in smears prepared in the ordinary way. In older cultures no trace of the threads can be found, unless some fine granular matter may represent them. These cocci represent the spore form of the organism, and when planted upon blood-serum the branching threads again appear. The spores stain readily with carbol-fuchsin and are not easily decolorized. They are spherical, or nearly so, but often appear somewhat elongated, apparently from beginning germination. They are killed by exposure to moist heat of 65° to 70° C. for an hour, but are more resistant to dry heat. Exposure, upon a silk thread, to a temperature above 120° C. for an hour and a half did not affect their vitality. The last sixty minutes of this time was at 125° to 127° C., and the bulb of the thermometer was within the tube in contact with the thread. No growth was obtained after an hour's exposure at 135° C. Drying destroys the threads after a comparatively short time, but the spores retain their vitality for an indefinite period. A dried-up potato-culture which was planted March 1, 1900, and has stood in the laboratory ever since, still retains its vitality at the end of almost four years. Plants made from this specimen upon blood-serum show an abundant yellowish growth at the end of twenty-four hours.

The germination of the spores and the growth of the threads was observed under the microscope in a hanging drop in the chamber of a hollow slide. Although the spores are seen to swell and elongate throughout the drop, only those around the edges of the drop develop to any considerable extent. The growth takes place outward from the edge of the drop along the moist surface of the glass. Here all stages of growth may be seen, from the elongated spore to the fully developed branching organism. The spore sends out a delicate sprout which very early looks like a bacillus with a bulbous extremity. The sprout soon branches, and the growth proceeds rapidly with frequent branching in all directions. Slight clubbing of the ends of the branches is often seen, but generally the ends are not club-shaped. In a few stained specimens an extremely delicate, almost colorless, clubbed-shaped

structure was seen at the ends of the branches. This appearance was not constant, and possibly was produced artificially. It can be seen in some of the photographs.

The development of the spores was not so easily demonstrated. The growth upon potato differs from the growths on other media not

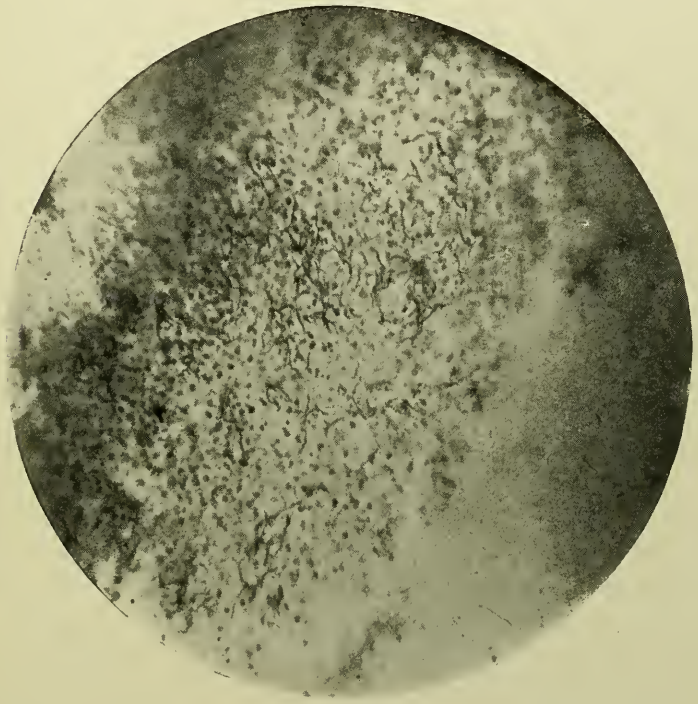

FIG. 5.—Streptothrix tubercle showing the threads.

only in color but also in consistency. Instead of being tenacious and difficult to separate, it is finely granular and is easily pulverized. In specimens taken at frequent intervals from potato-cultures the threads become more and more broken up into short fragments, and the number of free spores increases very rapidly. Some of the fragments appear to have a spore at each end, and some have three or more spores. The free spores show no regular arrangement, but occasionally a short chain of five or six can be found. By planting the threads upon minute bits

of potato upon a slide kept in a moist chamber it was possible in a few instances to observe the manner of sporulation. The ends of the branches appeared to break up into chains of cocci with very little evidence of a covering. Sometimes they preserved the line of the thread, but very often they were arranged in crinkled or zigzag lines. The slightest manipulation or jarring disturbed this arrangement and caused them to fall apart into irregular clusters. In the older portions of the threads the spores are not so numerous, and there is apparently no regularity in their arrangement. In potato-cultures two or three days old no threads can be found, or, at most, some faintly stained fragments.

The identity of this micro-organism is not fully established. It is undoubtedly a streptothrix, but it does not agree in all particulars with any of the varieties described. It approaches most nearly Eppinger's variety, but at no stage of its growth is it ever motile. The color and character of the growth upon different media and the sporulation upon potato agree with the descriptions of the streptothrix Eppingeri.

Animal Inoculations.—A considerable number of rabbits and guinea-pigs and two cats were inoculated with cultures of the streptothrix in different ways. These tests were not begun until four months after the original cultures were obtained. It has been stated that the streptothrix rapidly loses its virulence in cultures, and for some time the results of the inoculations seemed to confirm this statement. A number of rabbits and guinea-pigs were inoculated subcutaneously upon the abdomen and in the neighborhood of the cervical, axillary, and inguinal lymph-nodes with colonies broken up in salt solution. Indurated swellings were produced at the point of inoculation and a number of abscesses resulted. The abscesses developed rapidly and some of them opened spontaneously, while others were incised. The material evacuated did not resemble ordinary pus, but was thick and mucilaginous and exceedingly tenacious, like that from the subcutaneous abscesses of the patient as described above. The microscopical appearance was the same, and the streptothrix threads were found in considerable numbers. Pure cultures of the streptothrix were easily obtained from the pus whether the abscesses ruptured spontaneously or were incised. Indeed, in all of the inoculation experiments it was

very rare that the cultures showed any other micro-organism besides the streptothrix. Not a single instance of mixed infection occurred. After the evacuation of the abscesses, either by rupture or by incision, the surrounding induration gradually disappeared and the ulcers

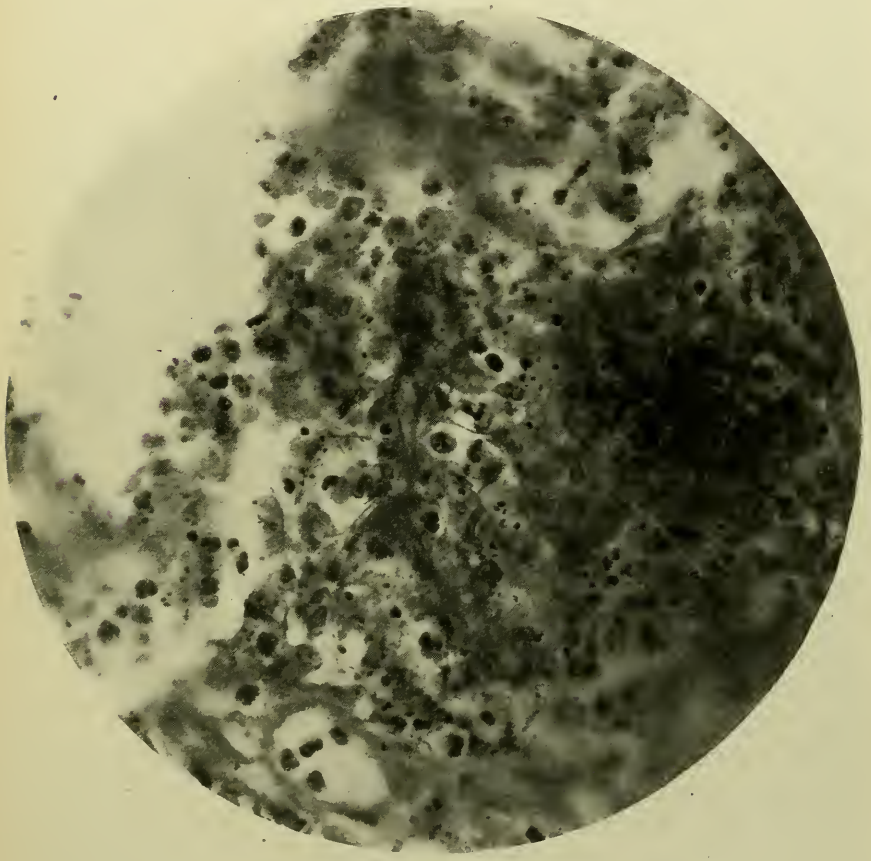

FIG. 6.—Streptothrix in lung, highly magnified. Original case.

healed. In many cases the induration did not result in abscess but gradually resolved. The animals showed no signs of illness and none of them developed a general infection or died. Several rabbits and guinea-pigs and two cats received peritoneal inoculations, but none

of them showed any sign of infection. Sometimes at the point of inoculation a few tubercular nodules were found at autopsy, but cultures were not obtained from them. No local infection of any consequence and no general infection was produced in this way. Thus far little virulence had been shown by the streptothrix in inoculation experiments. But when rabbits were inoculated intravenously, a rapidly fatal general infection was produced, and the lesions were similar in kind and distribution to those described in the human subject. A description of one of these experiments in detail applies to all of the intravenous inoculations: A vigorous, healthy rabbit, weighing sixty-four ounces, was inoculated through a vein of the ear, March 20, 1899. Two or three small colonies of the streptothrix were thoroughly broken up in salt solution and about 2 c.c. of the mixture was introduced into the vein. For about a week the rabbit was lively and continued to eat, but was evidently losing flesh. It then began to show signs of illness, becoming more quiet and less inclined to move about, though its appetite continued fairly good. Progressive emaciation and loss of strength in spite of a fair appetite continued until the seventeenth day, when the rabbit lay upon its side unable to move, and was apparently at the point of death. It was then chloroformed and immediately examined. Emaciation was the most striking feature of the case. From sixty-four ounces on March 20, the weight diminished to fifty-eight ounces on the 25th; to fifty-one ounces on the 30th; to forty-six ounces on April 1; and to forty ounces on the 6th, when the rabbit was killed.

Autopsy.—The body is extremely emaciated. There is a fluctuating swelling around the right elbow-joint, which is found to contain a thick, tenacious, mucoid fluid like that described above. No other superficial swellings are found. There is no trace of subcutaneous fat. The skeletal muscles show many minute white tubercles scattered over their surfaces and throughout their entire substance. These are mostly round, but many are somewhat elongated in the direction of the fibres. The surface of the heart is thickly dotted with minute rounded tubercles, which project beneath the pericardium. They are also found in the substance of the muscle. The lungs show just underneath the pleura an immense number of these tubercles, which give a shot-like feeling as the finger passes over them. They are found to be evenly

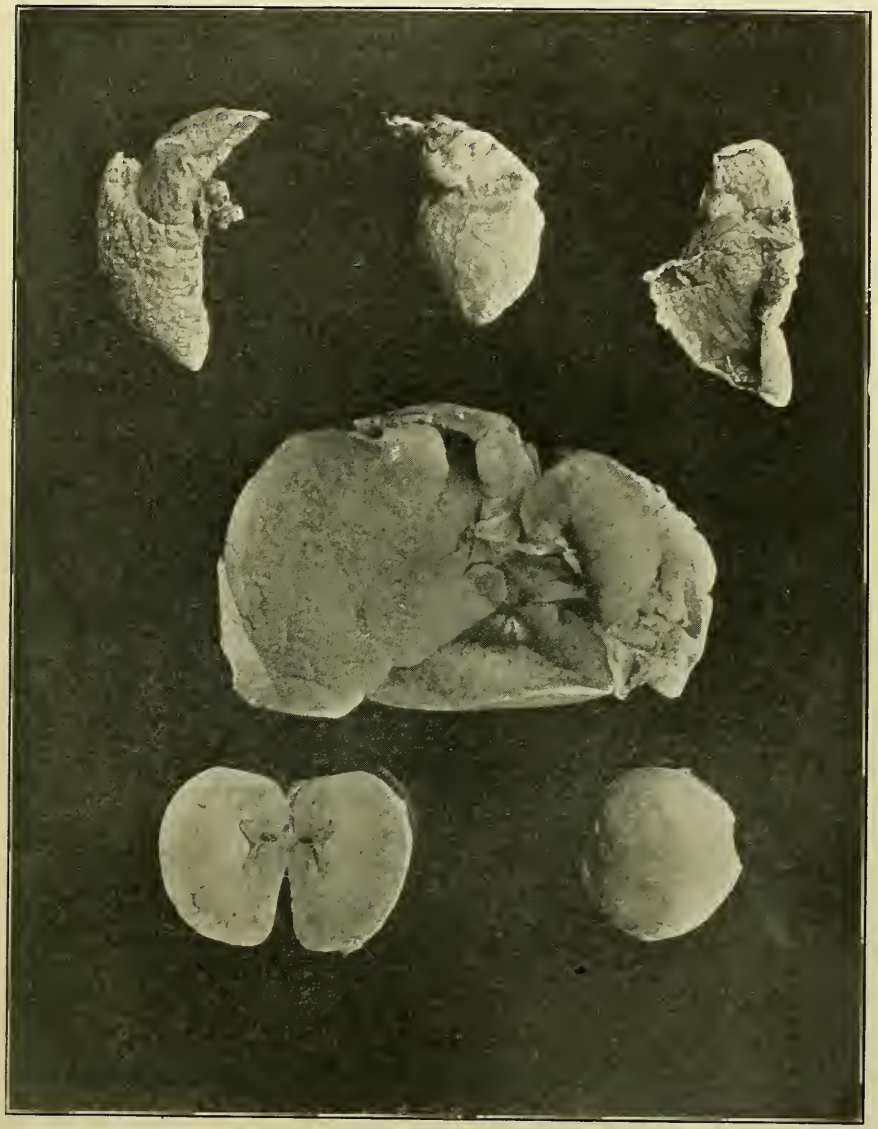

FIG. 7.—Lungs, heart, liver and kidneys of rabbit, showing streptothrix tubercles.

distributed throughout both lungs. The abdominal cavity contains no adipose. The stomach contains some food. The peritoneum, both parietal and visceral, is studded with tubercles. The liver and kidneys show both on the surface and on section immense numbers of tubercles. In short, practically every tissue and organ of the body contained a greater or smaller number of these minute bodies, which closely resembled ordinary miliary tubercles, but were possibly a little whiter and more opaque. No abscesses were found. The character and distribution of the lesions were the same in all of the rabbits inoculated in this way, and emaciation was always extreme. The number of tubercles found in different animals varied considerably, but the kidneys in every case showed the most pronounced infection. In every case the streptothrix was obtained in absolutely pure cultures without the use of plates. A solid organ (liver or kidney) was laid open with a sterile knife, and a number of the tubercles were removed and crushed between sterile slides, and the material thus prepared was rubbed into the surface of the medium. The fact that it was necessary to crush these bodies shows that they were genuine tubercles and not minute collections of pus.

The microscopical examination of the different tissues showed tubercles of the same structure as those in the original case. They are minute collections of cells resembling lymph-cells, with some polynuclear leucocytes. Many of the tubercles have granular centres, but the more minute ones show no signs of degeneration. The streptothrix threads can be demonstrated in almost all of the tubercles, and it is probably due to faulty staining technic that they cannot be found in all. The number or size of the organisms varies from a small fragment in the midst of a collection of cells, to a dense network of threads occupying the entire tubercle. In a few instances a cluster with radiating branches was found somewhat resembling an actinomyces granule. But these were evidently due to the lodgment of a small fragment of a colony which was not thoroughly broken up. In only one instance, that of a rabbit killed six days after inoculation, were giant cells found. At the edge of a few of the tubercles in the liver - typical giant cells were seen, but none was found in any of the other tissues or organs.

Subcutaneous inoculations, from one rabbit to another, and with

young cultures obtained from rabbits, produced only local symptoms such as have been described above. The virulence of the organism in intravenous inoculations did not appear to be increased by its recent passage through animals.

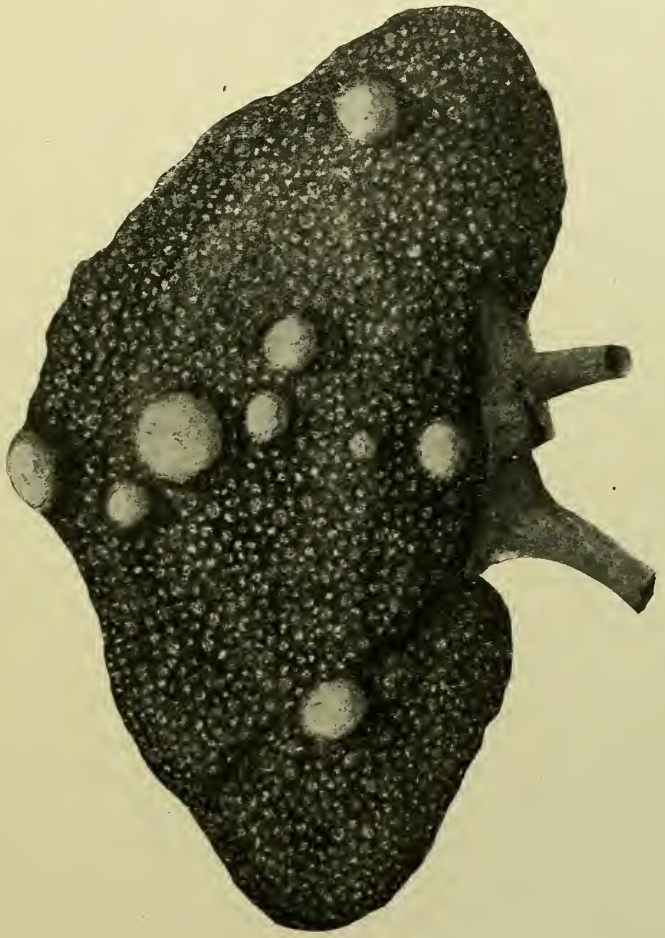

FIG. 8.—Kidney, from an original drawing. (See page 151.)

These experiments were repeated with rabbits in 1901, and again in 1902, and always with uniform results. The duration of the disease in rabbits, inoculated in a vein, was from fourteen to seventeen days.

Only once did a rabbit die as early as the fifth day, and this one probably received more than the usual dose. Very minute tubercles were found in every tissue and organ of the body. Attempts to produce chronic lesions were not successful. The animals either died in a short time or all traces of the disease disappeared. The results were always the same, whether the threads or the spores were used in inoculations. No evidence of spore-formation was discovered in any of the organisms within the tissues.

The causal relationship of this streptothrix to the disease in question seems to have been abundantly proven. The tubercular lesions repeatedly produced in rabbits were identical in appearance and structure with those found in the original case. The streptothrix alone was found in the lesions and was the only organism obtained in cultures from the lesions. The symptoms and lesions produced in rabbits by intravenous inoculation were always the same, and curiously the duration of the disease was practically the same as in the human subject. The tenacious, mucoid consistence of the abscess contents was the same in both, and in both the kidneys showed the most numerous tubercles.

The writer concludes from animal experiments that this variety of streptothrix has ordinarily but little virulence, but that if in any way it gains access to the blood it produces a rapidly fatal general infection which strikingly resembles acute miliary tuberculosis. In most of the cases reported the infection has apparently taken place in the lungs, where access to blood-vessels is comparatively easy. But the source of the infection and the manner in which it is implanted in the lung are unknown. Whether a previous lesion is necessary, or whether the inhalation of the threads or spores into the sound lung is sufficient to produce the disease, are questions for further study. The fact that the introduction of the threads and spores into the peritoneal cavities of rabbits, guinea-pigs, and cats did not produce an infection suggests that a previous lesion or disease may be necessary to provide a suitable soil for growth.

The natural habitat of this streptothrix is unknown. It is evidently able to grow upon various kinds of dead vegetable matter when the conditions of heat and moisture are suitable. It has been shown that in summer it grows vigorously at the temperature of the air, and when

the soil is unsuitable, or perhaps rather dry, it produces spores with astonishing rapidity. There is apparently little danger of infection with the fully developed threads. The dense, matted colonies and layers are not easily broken up when moist, and drying soon destroys them. But the spores form a crumbling, almost mealy, layer, and when dry are easily blown away and carried about by the air. They retain their vitality, when dry, for years, and grow very quickly when placed in favorable conditions. The threads, in some circumstances, might be a source of danger in the summer, but the air-borne spores might easily be deposited in places where they would be a source of danger for indefinite periods of time and in all seasons of the year.

From widely scattered localities and at long intervals of time, reports have been published describing unique cases of disease produced by varieties of micro-organisms belonging to the genus streptothrix. In some of these cases points of similarity can be recognized in the clinical symptoms and the gross pathological lesions, while others differ widely in both respects. But in no two cases reported up to the present time have the descriptions of the micro-organisms found agreed in all particulars. In some cases no attempt at cultivation was made. In other cases numerous and careful plants on various culture-media failed to develop the specific organism. In the remaining cases in which the streptothrix was obtained in pure culture, the descriptions of the growth characteristics essentially differ. Leaving out of account the more thoroughly studied members of the vaguely defined family to which these micro-organisms belong—namely, the actinomyces, the tubercle bacillus and the diphtheria bacillus—the writer has been able to find the reports of only twelve cases in which a streptothrix was found in sufficient abundance to have been an important, if not the principal, factor in producing disease. These cases were all fatal, and only once was the character of the disease recognized during life. As the clinical symptoms and the lesions in the human subject as well as in the animals experimentally inoculated with the streptothrix often resemble those of miliary tuberculosis, so that a number of these cases have been reported as pseudo-tuberculosis, the question is naturally suggested whether such cases of streptothrix tuberculosis are not more numerous than the few reported cases would indicate. The almost universal prevalence of genuine tuberculosis and the extreme gravity

of the disease have so long occupied the attention and study of the medical profession that much is taken for granted, and cases in which the symptoms and lesions resemble with some closeness those characteristic of the well-known disease may easily be set down without question to the account of the tubercle bacillus. The cases of streptothrix tuberculosis so far reported have all been fatal, and the lesions for the most part have been widely distributed, but in a number of cases old lesions have been found which suggest that the disease may have been localized for a longer or shorter time, and then, by some accident, may have become rapidly general. In this respect, also, these cases may resemble tuberculosis. Whether all cases of streptothrix disease in the human subject are general and fatal, or, as in tuberculosis and actinomycosis, there may be cases of localized disease which recover, are questions which have not been decided at the present time. The methods employed to demonstrate the presence of tubercle bacilli render the streptothrices invisible. Again, unless the observer keeps in mind the possibility of streptothrix infection, he may not appreciate the importance of the slender threads with or without branches, and may consider them accidental bacilli or varieties of leptothrix or non-pathogenic fungi. As the lungs have appeared to be the seat of the primary infection in most of the cases of human streptothrix disease, it is the opinion of the writer that all cases presenting the physical signs of tuberculosis, in which repeated examinations fail to discover the tubercle bacillus, should be systematically examined for streptothrix threads. In this way alone can the frequency of the disease be determined. Gram's method of staining or the Ziehl-Neelson solution decolorized with aniline oil seem to be the most reliable agents for demonstrating these organisms. The streptothrices are widely distributed and are not very infrequently met with, but as yet, with the exceptions mentioned above, very little is known about them. Kruse mentions nineteen varieties, including the actinomyces. Some of them are non-pathogenic; some are pathogenic for certain animals, and others are pathogenic for both man and animals. In studying the descriptions of the different varieties of these micro-organisms, it has seemed to the writer that, as in the case of certain bacteria, different observers may possibly have described the same variety under different names. More complete and accurate descriptions are needed in many

instances for the proper identification of the species. Any contribution to the knowledge of this important genus is of value not only with regard to the pathogenic possibilities of some of the species, but also as an aid to a comprehensive knowledge of the whole family to which the tubercle bacillus has been found to belong.

VIII.

MALPOSITIONS OF ADRENAL TISSUE IN AND ON THE KIDNEY.

By Wm. N. Berkeley, M.D.

This brief notice is given here not because the condition is very rare, but in order to record its relative frequency in our autopsy experience, and to show the actual histology.

In the last 2,000 autopsies made here, adrenal malpositions in or on the kidney have been noticed five times. All the cases were in adult males. The age at death is of no special consequence, as the condition is doubtless always congenital. In one of the cases (IV) the adrenals were equally adherent on both sides; in the others no note of the side affected has been made.

Case I (Card No. 2862).—This specimen is a wide, flat adhesion of the adrenal gland on one of its sides to the upper pole of the kidney. The adrenal tissue cannot be separated from the kidney without rupture. Microscopically the renal capsule is found to be partly absorbed, but mostly intact. Where it is absorbed, the cells of the two organs lie side by side without demarcation.

Case II (180, *2d S.*).—In this case the suprarenal was tightly adherent but partly detachable. The renal capsule was intact. The adrenal tissue on cross-section makes a visible nodule at the margin of the kidney.

Case III (1858).—Adrenal not detachable without rupture. Renal capsule complete. Very similar to Case II.

Case IV (4356).—Here the renal capsule is partially absorbed and the adrenal indents the renal surface (Fig. 1). It will be seen from the drawing that the kidney is in an advanced state of inflammation, much of the cortex being fibrosed. The condition was similar on both sides.

Case V (7465).—This case, of which only a small part is shown in Fig. 2, is one in which a nodule of adrenal tissue (about one-sixth of an inch through) appears *under* the thick capsule of one (inflamed) kidney. The adrenal cells lie in close apposition to the tufts and tubes of the kidney. Even with the highest power of the microscope no dividing line of connective tissue can be found. The columns of adrenal cells penetrate the renal tissue in tortuous outlines, forming one of the most interesting of known examples of the "cell-balance"

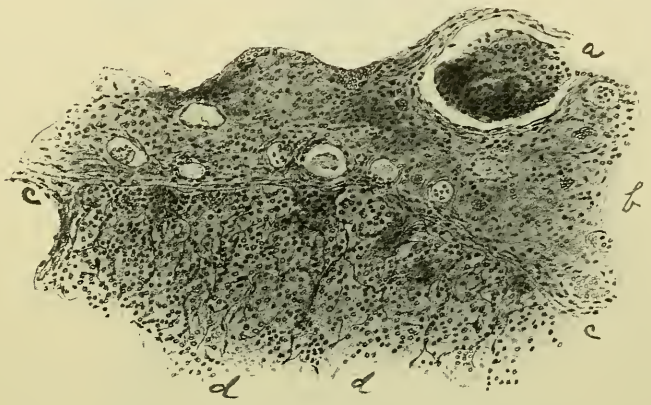

FIG. 1.—Adrenal adherent to and indenting surface of kidney. *a*, Dilated tuft; *b*, inflamed and altered renal tissue; *c*, partly absorbed capsule; *d*, adrenal tissue.

of different tissues lying in contact. The suprarenal tissue looks normal.

COMMENTS.—Adrenal inclusions in the kidney were known already to Rokitansky. The literature of the subject is extensive, and it will be needless to give more than a few references. Minute bits of included adrenal have been seen singly and in groups on and in the capsule and in the cortex of one or both kidneys. M. Borst [1] and Beneke [2] have observed the renal cortex from one-third to all of its extent sprinkled with adrenal dots. E. Schäfer [3] mentions partial inclusions in the liver and kidney as "not uncommon." E. Ziegler [4] says they are "not very infrequent." E. Neusser [5] sums up the anatomical variations of adrenal tissue as follows: Portions of the gland occur separately, at the hilum of the gland itself, like the supernumerary spleen. They are

also found in the solar plexus, the cœliac ganglion, beneath the capsule and in the vortex of the kidney, opposite the sacro-iliac articulation, and especially along the course of the spermatic cord and internal spermatic vessels from the retroperitoneal space to the epididymis.

FIG. 2.—Nodule of suprarenal tissue under capsule of kidney. *a, a*, Renal tubercles; *b, b*, adrenal tissue; *c*, cells of a single adrenal column, enlarged; *d, d*, capsule.

In the female they may be found in the broad ligament close to the parovarium—more often on the right than on the left side.

Borst (*l. c.*, quoting from Grawitz) suggests that the condition is due to fœtal inclusion, between two renal lobules (*renculi*), of small bits of adrenal dislodged in development. It is a fact (Neusser, Grawitz) that in the fœtus the suprarenals are larger than the kidney, and are widely superimposed over its upper end.

As physiological accessories and as sources of the "aberrant adrenal" tumor—the latter often a grave malignant disease—the importance of adrenal malpositions need not be further discussed.

[1] Max Borst: Lehre v. d. Geschwülsten, Bd. II, Wiesbaden, 1902.
[2] Beneke: Ziegler's Beiträge, Bd. IX, p. 440.
[3] E. Schäfer: Quain's Anatomy.
[4] E. Ziegler: Pathological Anatomy.
[5] E. Neusser: Nothnagel's Encyclopedia of Practical Medicine, Philadelphia, 1903.

IX.

INTESTINAL OBSTRUCTION FOLLOWING APPENDICITIS OPERATIONS. REPORT OF EIGHTY-SIX CASES AND THE LITERATURE.

By Clarence A. McWilliams, M.D.

The literature on the subject of appendicitis has reached enormous proportions, and on first sight it would seem that all has been said which could be said without needless repetition. One aspect of the subject, however, has not been sufficiently emphasized. It is the disastrous number of sequelæ which may result from an appendicitis which has gone on to the formation of an abscess either within or outside of the appendix. A partial list of those most frequently occurring is as follows: Lymphangitis, lymphadenitis, especially of the mesenteric and retroperitoneal glands; venous thrombosis of the right or left iliac and portal veins, Douglas's and tubo-ovarian abscesses, psoas abscess, lumbar abscess, perinephritic abscess, subphrenic abscess, septic hepatitis, hepatic abscess, septic cholangitis, septic cholecystitis, septic pneumonia, abscess of the lung, empyema, pancreatitis, septic ulcer of the stomach with hæmatemesis, fecal fistula, intestinal adhesions, bands and obstructions, post-operative hernias, ureteral obstruction, pyemia, inflammation of the parotid gland, ischio-rectal abscesses, rupture of abscesses into cæcum, colon, rectum, or bladder, secondary hemorrhage from the artery of the appendix, circumflex iliac artery, or iliac vein, acetonæmia, etc.

Surgeons thoroughly appreciate the dangers of waiting before operating in cases of appendicitis, and their zeal in the matter of early operation has often been wrongly attributed by their medical *confrères* to operative enthusiasm. Evidence, however, is rapidly accumulating to convince the most incredulous that their position is a most sound one, based on both clinical and pathological findings. In this list of sequelæ, perhaps no single one is more to be dreaded than intestinal

obstruction. This condition is the result chiefly of the delay for what is commonly known as "walling off," which means the waiting for the abscess to be surrounded by adherent intestines. No one can tell when these adhesions may produce intestinal obstruction, and surely in any disease we must take into account just as much the remote results as the immediate ones. We may also say without fear of contradiction that there has been a time in every fatal case of appendicitis when an operation would have saved the patient.

In a study of 1,000 operations for acute intestinal obstruction and gangrenous hernia made by Dr. Charles L. Gibson (*Annals of Surgery*, vol. xxxii, Nos. 4 and 5), he found "bands" to be the cause of obstruction in 186 cases, this being the commonest form of acute obstruction in the adult. "These were most frequently from inflammatory remains of appendiceal troubles and from the female pelvic organs. While the subject for simplicity's sake is treated under the heading of bands, it must be borne in mind that many of these are in the form of diffuse, velamentous adhesions, causing obstruction by kinking and knotting of the intestines, as well as by direct diminution of the calibre of the intestine, and strangulation of the blood-supply."

Fifty-eight per cent. of these 186 cases were in males; and the site of the obstruction was the small intestine in eighty-six per cent. of all the cases.

In taking up this subject, I shall first report *in extenso* two of my own cases, one of which had two post-operative attacks of intestinal obstruction successfully operated upon, the second case having eighteen inches of gangrenous intestine. Following this are all the cases which I have been able to find in the literature on the subject. In addition, there will be found a number of unpublished cases, occurring in the practices of various surgeons who have been kind enough to allow me to publish them. Lastly, there will be found a general discussion of this vital and interesting topic.

E. L.; female; single; Russian; cigar-maker; admitted to the Presbyterian Hospital September 11, 1903, with the following history: Family and previous history negative in every respect. Present trouble began two days prior to her admission, when she was suddenly seized with sharp pain in the epigastrium, accompanied with vomiting. The next day this pain localized itself in the right iliac fossa, where

it became exceedingly tender. Vomiting continued occasionally with nausea until admission. Bowels moved normally.

On admission, temperature was 101⅘°; pulse, 120; respiration, 32. Patient is pale, anæmic. Whole abdomen is tender and somewhat distended, and moves but slightly with respiration. Tenderness most marked in right iliac fossa, where there is very great muscular rigidity, which makes the detection of a possible underlying mass impossible, although it was supposed to exist.

Immediate Operation (Gas and Ether being employed).—Intermuscular incision with blunt separation of the muscles in the direction of their fibres. Appendix found retrocæcal, surrounded by a pocket containing about two ounces of thick pus and swollen to the size of one's thumb, and intensely congested. The base of the appendix was gangrenous, with a perforation about half an inch from its insertion into the cæcum. Double ligature of plain catgut applied to its base, which was cauterized after amputation of the organ. No irrigation used. Two small drains of gauze, wound about with rubber tissue, were led down to the appendix site. Remainder of wound closed with catgut in layers. Time, thirty minutes. Condition post-operative, good. After the operation all the symptoms became ameliorated. Temperature and pulse gradually lowered. On September 18, eight days after operation, highest temperature 101.5°; pulse, 85. On the ninth day the temperature suddenly dropped from 101° to 97°, and the pulse became 100. She complained of cramp-like abdominal pains and she began to vomit. On the tenth day symptoms referable to the abdomen were better, until the night of the second day of her pain, when her condition became more serious. At midnight the temperature was 96°; pulse, 120. The vomiting was frequent and very foul, abdomen distended, but not at all tender. Numerous high enemata failed to bring away any fecal material or gas. Early in the morning of the third day, the eleventh day after the first operation, the vomiting had become fecal, entirely unrelieved by lavages, and there had been no bowel movement. The abdomen was more distended, with slight general tenderness. Vigorous peristaltic sounds could be heard all over the abdomen with the stethoscope, and there was almost no muscular rigidity. From the lack of rigidity and marked tenderness, and the presence of vigorous peristalsis, it was evident at once that

we had to deal with a mechanical obstruction, and not an inflammatory one. The pulse was poor and 130.

Operation, September 21, 1903, 10 A.M. (Gas and Ether).—Median incision above the pubis. Much distended small intestines presented. Pads inserted, drawing the intestines over toward the left iliac fossa, so as to give a clear view of the appendix region, where it was surmised the trouble lay, and so it turned out to be; for it was seen at once that the two extremities of a single coil of small intestines were adherent to the abdominal wall in immediate juxtaposition to each other. The portion of the coil distal to the adhesion had become twisted upon itself, obstructing completely its lumen; for the portion of the intestine leading up to the point of adherence was ballooned to the size of one's arm, while the coil leading away from the adhesion was completely collapsed. As soon as the twist was undone the gas passed on rapidly into the collapsed intestine. One extremity of the twisted coil was loosened from its adhesion to the abdominal wall, and an area on its surface, denuded thereby of its serous coat, was closed in by a Lembert suture of fine silk. The other extremity could not be loosened on account of the firmness of the adhesions, so it was left as it was. Patient in bad condition, requiring an intravenous infusion of salt solution. Rapid closure of the abdomen by silk-worm gut sutures passed through all the layers. Five dejections followed the operation the same day without any artificial assistance. Vomiting ceased a few hours after the operation. Pulse the next day 100 and the patient very comfortable, the temperature being 100°. No distention.

The subsequent course was uneventful until the midnight of October 6, 1903, being the twenty-fifth day after the first operation, and the fifteenth day following the second one. She then began to vomit large amounts of undigested food. Vomiting continued the next day, unrelieved by repeated lavage. Enemata failed to evacuate gas or fecal material. During the day the abdominal signs developed exactly as they had in the previous attack of obstruction.

Operation (twenty hours after the onset), *October* 7, 10 P.M.—Gas and Ether. Previous median wound reopened without cutting. Distended small intestine presented. A less distended loop was followed down in the direction of increasing distention and resistance until a point was reached where the coil was tightly adherent to a neighboring loop.

This had produced a kink in the afferent loop, causing absolute occlusion of its lumen. Beyond this adhesion the intestine was collapsed. The adhesion between the loops was separated, leaving a raw area on each loop the size of a quarter of a dollar. Gas passed immediately onward into the collapsed bowel. The raw areas on each loop were covered in with interrupted Lembert sutures of silk. No further raw areas were discovered after search. Relief was almost immediate after the operation. She vomited twice very foul material. There were three stools in the course of the following fifteen hours, and all pain ceased. Complete convalescence followed without a setback. The patient left the hospital on November 8, 1903, fifty-eight days after the first operation, forty-eight days after the second one, and thirty-two days after the third operation. On December 26, 1903, the patient was seen, and said she was in the best of health and had no digestive disturbances, bowels constipated. She was instructed to return immediately to the hospital on the appearance of any symptoms of obstruction.

The second case is as follows: Mrs. N. C.; aged twenty-eight; admitted to the Presbyterian Hospital October 3, 1903, 11 P.M., with the following history: Three years ago operation in Philadelphia for appendicitis, two rubber tubes being left in as drains. Never any other serious illness. Seven weeks previous to admission, miscarriage, for which curettage was performed. Convalescence uneventful.

Three days before admission patient was seized with severe burning pain in abdomen, which was not localized, but general. It was often very colicky. Later it seemed to be most intense in the lower median part of the abdomen, where it became very tender to the touch. Prostration soon became marked. She vomited constantly, and for four days there had been no movement of the bowels nor passage of flatus. Examination elicited the following points: Hippocratic facies marked, tongue dry, foul, coated with brown fur. Odor of breath foul. Temperature, 104.8°; pulse, 140, poor quality but regular. Heart and lungs normal. Abdomen distended, and moved scarcely at all with respiration. Over the appendix region is a four-inch scar, evidently the result of a suppurating wound. Great tenderness over whole of lower half of abdomen, most marked in right quadrant, where there seemed to be a soft, semi-elastic mass the size of a grape-fruit, very

indefinite in its outlines but extending over to and beyond the median line, and down behind the pubis. There was a tympanitic note over the whole of the abdomen, and over the mass. Very faint peristalsis heard over the abdomen with stethoscope. Vaginal examination elicited in the right fornix a tender, soft, rather elastic, indefinite mass bulging down behind the uterus. Profuse leucorrhœal discharge.

There was evidently peritonitis present with intestinal obstruction, the etiology of which could not be determined. It was thought possibly to be due to an appendix abscess which had ruptured, but the more probable diagnosis seemed to be a ruptured pyosalpinx.

Operation, October 3, 1903, 1 A.M. (Gas and Ether being used).—Three-inch median incision above the symphysis. Free, foul-smelling, purulent fluid escaped on opening the peritoneal cavity. Omentum adherent to uterus and tubes. On separating this, a coil of distended, blackish, small intestine presented, the two extremities of the coil leading over to the appendix scar, where they were adherent to each other and to the anterior parietes. About one and a half inches from the adherent point the coils had twisted about each other, producing an evident obstruction not only to the passage of the intestinal contents, but also to the vascular circulation; for on attempting to lift the gangrenous intestine up, it broke away from its mesenteric attachment, practically of its own weight, and throughout the whole extent of the gangrenous area. There was no perforation anywhere and the gut was distended. It lay almost wholly in the pelvis, the walls of which were covered with a foul exudate, in places necrotic. Resection of the gangrenous gut was performed as quickly as possible with a medium-sized Murphy button, and without the escape of any of the intestinal contents. Measurement of the part excised showed it to be eighteen inches long. The excess of mesentery was reefed with catgut. Peritoneal cavity irrigated thoroughly with profuse quantities of hot saline solution. No trace of the appendix was seen at any time of the operation. Two large cigarette drains left in the lower angle of the wound, which was hastily closed with silk-worm gut sutures, passed through all the layers of the abdomen by means of a handle needle. Patient in bad condition, making a saline intravenous infusion of 1,500 c.c. at a temperature of 110° necessary on the operating table.

Patient's condition remained grave after the operation, responding

very slightly to all forms of stimulation. In the first twenty-four hours three hypodermoclyses of 1,000 c.c. of saline solution were given. There were also in this time four dejections as the result of turpentine enemata. Repeated lavage allayed the vomiting. Temperature next day was 105.5°; pulse, 140 and weak. Nutrient, stimulating enemata given. Patient died on the fourth day after the operation of progressively rapid sepsis, due to the purulent condition of the pelvic walls.

The following case occurred in the service of Dr. F. Tilden Brown, to whose kindness I am indebted for the privilege of recording it.

P. M.; female; aged twenty-nine; clerk. Four or five attacks of slight appendicitis. Admitted to hospital seventeen hours after beginning of present attack, on June 21, 1903, with a temperature of 101°; pulse of 90. Abdomen rigid all over, but this very marked in the right iliac fossa, where there was exquisite tenderness, but no mass. Intermuscular operation was at once performed. The appendix was intensely inflamed, and there was an ounce or two of pus about it. It was removed, and two small cigarette drains were left down to the stump, the wound being closed. Convalescence was smooth until the twentieth day, in the morning, when she was allowed out of bed for the first time. In the afternoon of that day, July 11, she complained of considerable pain in the abdomen, and vomited that evening and night several times. The next day the vomiting continued, and in the evening became fecal. No movement could be obtained by enemata, and she became distended.

Operation at Midnight, July 12, 1903, two days after the onset of the first symptom (Gas and Ether).—Vertical incision through the right rectus, whose muscular fibres were bluntly separated at the level of the navel. Serous fluid escaped from the peritoneal cavity, and there were many adhesions in the neighborhood of the cæcum. A band of omentum was traced through the peritoneum and found attached to the muscles in the old wound. The intestines had evidently looped over this so that a volvulus had formed. The band was cut and the twist reduced, air passing immediately into the collapsed portion of intestine. Closure in layers, a small drain being left in the lower angle. Patient had a good bowel movement the next day, and all her symptoms subsided. She went home August 15, 1903, fifty-five days after the first operation and thirty-three days after the second one.

We may divide the cases of obstruction occurring after an operation for appendicitis into three classes: 1. Immediate. 2. Early. 3. Late obstruction. The first class comprises those cases in which obstruction comes on immediately after the operation, from a few hours to a couple of days. The operation is in many cases never quite recovered from before the symptoms of obstruction gradually present themselves. The obstruction here is usually due to intestinal paresis alone, caused by a local or general peritonitis; this paresis, however, may be accentuated by the effect of adhesions. Rarely do we get here the mechanical effect alone of adhesions. In some cases before the primary operation the arrest of the passage of the fecal material and of gas may project so prominently in the foreground that the erroneous diagnosis of intestinal obstruction alone may be made, and the appendicitis be overlooked.

The second class, "early" obstruction, is that occurring a number of days or weeks after the primary operation, before the convalescence from this is complete, usually before the complete healing of the wound. It may be due to two main causes: (*a*) The development of secondary abscesses in remote portions of the abdomen; the actual pressure of such an abscess may of itself produce obstruction, or the adhesions about such an abscess may produce angulation of the gut sufficient to obstruct its lumen. The simple opening of such an abscess has often resulted in the immediate subsidence of the obstructive symptoms. (*b*) The second cause in this class, and the more frequent, is that due to mechanical obstruction, produced by adherent loops causing constricting bands about each other, or resulting in angulation, volvulus, internal hernia, etc. It is not a question of present peritonitis.

The third main class, "late" obstruction, may come on weeks, months, or years after the primary operation, or even after an antecedent appendicitis, which has not been operated upon. During this period there may be perfect health without digestive disturbance of any kind, or there may be more or less stomach difficulty, and attacks of constipation. The causes of obstruction in this class are the same as under *b* in the second class.

1. The symptoms of immediate obstruction, arising as they do within a few hours or a couple of days after the primary operation, are often puzzling, for our treatment will depend on whether it be produced by paralytic ileus, due to peritonitis, either local or general, or to a mechan-

ical obstruction, hence the importance of a correct diagnosis. In paralytic ileus we are apt to hear much decreased or no peristalsis over the abdomen with the stethoscope; in obstruction it is very vigorous and colicky. In the former, we may get a history of the passage of some gas; in the latter, obstruction is complete. In the former, pain may not be great; in the latter, it is violent and colicky and not localized. Collapse comes on early in the latter, and is severer. Vomiting is not so apt to be stercoraceous in paralytic ileus, and it is apt to be less projectile, less frequent, and less intractable. Muscular rigidity is much more pronounced and general in peritonitis than in mechanical obstruction. In the former the symptoms of progressive sepsis are more in evidence than in the latter.

The diagnosis between these two conditions is fraught in the majority of cases with the greatest difficulty, and is the cause of much anxiety to the surgeon. It is unquestionably true that many cases of mechanical obstruction have died unrecognized under the name of peritonitis. When in doubt, wait for a time the result of medicinal measures, *i.e.*, wash out the stomach with warm salt solution, putting in through the tube one drachm each of Rochelle and Epsom salts, which dose should be administered every hour until a result is obtained or a diagnosis is reached, employ high enemata containing olive oil and turpentine, or a solution of alum, which is often very efficacious, and give two or three hypodermics of atropine, gr. $\frac{1}{2}\frac{1}{0}\frac{1}{0}$, at intervals of two hours. Atropine is given with the idea that it increases peristalsis and contracts blood-vessels, but it is useless, of course, if strangulation exists. If these measures are not quickly followed by the passage of flatus or fæces, and the possibility of mechanical obstruction still exists, operation had better be performed at once.

It must not be forgotten that mechanical obstruction and intestinal paresis (peritonitis) may coexist at the same time.

Operation being decided upon in immediate obstruction, what procedure is the best? The mortality of these secondary operations, following closely a primary one, is frightfully high, due to the patient's prostrated condition. The quickest procedure, therefore, is urgently called for. A secondary abscess at a distance from the appendix site would call for an incision over its location. Barring this complication, we may reopen the wound, or make a median incision below the navel. Is the patient

in a low condition, then the former procedure may offer the greatest hope. A loop of distended small intestine presenting in the wound is incised. If our opening be above the site of the obstruction, then the quantity of gas and fæces evacuated will be large and can be increased by pressure on the abdomen, while neighboring coils of small intestine will collapse. In case our opening be below the obstruction, then we shall have to make another puncture in another loop. This procedure may likewise help in ileus depending on peritonitis alone.

In case the patient is in better condition, it may be wiser to quickly make a median incision in order to more thoroughly search for the obstruction. Evisceration may not be practised on account of increasing the shock. Peritonitis requires copious flushing of the abdomen with hot normal salt solution. Bands, etc., require appropriate treatment, while we may at times have to content ourselves with making an artificial anus, particularly in cases with general, extensive adhesions. Speed is a *sine qua non.*

2. "Early" obstruction as a rule presents little difficulty in diagnosis. The patient is convalescent from the original appendicitis operation when there is a sudden attack of sharp, colicky, abdominal pain, with vomiting which is intractable, soon becoming stercoraceous. Obstruction of the bowels is complete, no flatus even being passed. The abdomen is not tender, nor is there much muscular rigidity, and this is true likewise when later the intestines beneath become distended. Rigidity only is present when peritonitis comes on. No tumor is palpable. Peristalsis is violent above the obstruction, and is heard distinctly with the stethoscope. Shock is a prominent symptom, and the patient's condition becomes alarming, pulse rapid and weak, face very drawn and anxious, cold perspiration. The temperature drops to subnormal. The symptoms also may be subacute, due to the more gradual contraction of adhesions, or they may be coincident with the development of a secondary abscess at or far from the appendix site.

After a possible initial cathartic, no more should be given by mouth. High enemata, etc., should be tried, but as soon as a diagnosis is made no time should be lost before proceeding to an operation, without waiting for the subsidence of the shock, which latter may never occur. A median incision is in order. A distended loop of intestine is sought for, and followed in the direction of increasing distention and resistance,

until the obstructing cause is discovered and appropriate treatment applied. Practically the small intestine is the one always obstructed, and the seat of the difficulty will be found in the right iliac fossa in the great majority of the cases. Secondary abscesses may be found buried deep in a mass of adherent intestines, necessitating drainage. Kinks are untwisted and angulations straightened, etc. Raw areas resulting from the separation of adhesions are buried under Lembert sutures, or covered with Cargile membrane. Gangrenous areas in the intestine resulting from volvulus, internal herniæ, etc., are excised, and the ends either left in the wound, or brought together with a Murphy button. The abdomen is closed with the cavity full of salt solution, which may prevent the re-formation of some few adhesions. If the whole extent of the intestines is a great mass of inextricably agglutinated intestines, our only resort is to make an artificial anus.

Two measures besides high enemata, etc., may be employed to ward off an impending attack of mechanical obstruction, if used very early. One is vigorous abdominal massage. It is a very valuable procedure, and certainly has not received the attention it merits. The second is change in position of the patient, not only from side to side, but also particularly by elevation of the hips ; this may straighten out a beginning flexure, and may change the direction of the peristalsis so that it will not impinge on a fixed point (Morris).

3. "Late" obstruction, as we have seen, may occur years after an appendix operation, so long previous that its connection with the present attack may not be thought of. It may occur also a long time after an appendicitis which has not been operated upon, for surely the adhesions may occur just the same without an operation as with. This latter fact needs decided emphasis. The symptoms may be acute or chronic in character. The acute attack comes on without a premonition in a perfectly healthy person, either without any appreciable exciting cause, or after violent exercise, or a heavy, indigestible meal. It begins as a violent colic which yields to no treatment. Peristalsis is exaggerated, but ineffectual, as no gas or fæces are passed. Vomiting comes on at once and is persistent, becoming sooner or later fecal in character. Temperature remains normal for some time (may be subnormal from shock) until peritonitic inflammation arises. Shock is often a pronounced symptom, and the pulse gradually rises and becomes weak. The abdomen pro-

gressively distends. There is but slight muscular rigidity until peritonitis comes on.

The diagnosis soon becomes clear, and no time should be lost before operating. A median incision should be made below the navel and the obstruction relieved by adopting measures appropriate to the conditions found.

Chronic obstruction has a more gradual and progressive course. Following the original appendicitis, whether operated upon or not, there may be a period of longer or shorter duration of perfect health, or the patient may complain of digestive disturbances, particularly from the side of the bowel activity. Constipation becomes more and more marked, relieved with more and more difficulty by cathartics and enemata. There may be slight attacks of intestinal colic with nausea. A diagnosis may be made at this stage, and that much to the patient's advantage. It would seem at this stage that abdominal massage and electricity might avail to ward off complete obstruction. Careful watching of a patient with a history of appendicitis and with the above symptoms will enable the right diagnosis to be made. Oftener, however, that of intestinal indigestion is made, and the patient is plied with drugs, and put upon a rigid diet, with the result of causing loss of flesh and strength often of extreme degree. Chronic obstruction is caused by the gradual contraction of adhesions between two loops of bowel, or about a loop, or the gradual or periodic forcing of a coil beneath a band, etc., resulting in a progressive diminution in the calibre of the bowel. Persistence of these symptoms urgently requires operative interference. Sudden complete obstruction may come on at any time without obvious cause, or determined by an over-hearty meal or violent exercise. The symptoms then of acute complete obstruction are in full evidence, requiring active operative treatment.

Kocher, in the article later cited, lays down the following propositions: 1. The chief danger in each case of ileus rests upon the disturbances in circulation in the bowel-wall and its consequences, namely, venous hyperæmia leading to hemorrhages and infarcts, œdematous infiltration and the collecting of decomposing fluids in the intestine, injury to and exfoliation of the epithelium and the consequent permeability of the bowel-wall for the passage of ferments, toxic substances, and bacteria.

2. This permeability leads, on the one hand, to general intoxication and infection, and, on the other, to local inflammation of the bowel-wall, necrosis of the same with ulcerations, perforation, and peritonitis.

3. The circulatory disturbances in the intestinal walls are caused by pressure from without upon circumscribed portions of the wall, and also by pressure upon the mesenteric vessels, due to strangulation by bands, internal herniæ, volvuli, invaginations, etc.

4. Not less dangerous circulatory disturbances are caused by pressure from within, resulting from the stagnation of the intestinal contents, increased transudation and secretion above the obstruction, and the consequent overstretching of the bowel-wall.

5. In every case of ileus the immediate removal of the circulatory disturbances of the bowel-wall is indicated. This is accomplished not only by removal of the extra-intestinal pressure, but also by doing away with the intra-intestinal stretching; the first can only be accomplished by means of a laparotomy,* the second without such a procedure, as by the formation of an artificial anus.

6. The slow development and chronic course of an ileus in no way restricts the absolute validity of the aforesaid indication, since the severest forms of ileus begin slowly, and the chronic forms may suddenly become acute.

7. The operative treatment of each case of ileus should be considered from the first moment. The non-operative treatment is suitable simply for those cases of obturation and dynamic ileus in which a strangulation ileus can surely be excluded.

8. The removal of the obstruction to the intestinal contents is desirable, but the removal of the circulatory disturbances in the bowel-wall is an absolute necessity of any operative procedure. Since the first indication in all forms of ileus is adequately met by a laparotomy, this is to be preferred in all forms in the beginning stages. In the late stages of obturation and paralytic ileus the palliative operation (artificial anus) is indicated.

9. The previously bad prognosis of the operative treatment of ileus is exclusively caused by the too long delay in the carrying out of the

* By this Kocher evidently means the thorough searching for the cause itself of the obstruction.

operation, resulting in gangrene of the wall, due to extra-intestinal pressure, or intra-intestinal stretching from increasing decomposition of the bowel contents.

10. On account of the frequent uncertainty of the diagnosis in the early stages, a satisfactory recovery can only be expected by means of the radical operative treatment of every patient in whom there is a well-founded suspicion that a mechanical obstruction exists.

We may divide the cases with reference to the previous operation as follows:

1. Those in which the ileus occurs at the site of the previous operation.

2. Those in which the ileus occurs independent of the site of the previous operation, or afar from it, and only being indirectly due to it.

3. Ileus where no lesion can be found, *i.e.*, paralytic ileus.

Tavel, in a very elaborate and instructive series of articles (*Revue de Chirurgie*, October, November, December, 1903) on ileus in general, with particular reference to the diagnosis of the seat of the occlusion, gives the following symptoms of occlusion in the various regions of the intestinal canal:

1. *Pyloric Occlusion.*—The vomiting contains food with mucus sometimes mixed with blood, but without bile. The vomiting is no more in amount than is swallowed. There may be a few infrequent stools, and there is some passage of flatus. Pain is located in epigastrium and back. Resistance in pyloric region. Distention is local, limited to the outlines of the stomach, and does not fill up the whole epigastric region, as in duodenal occlusion.

2. *Duodenal Occlusion.*—Vomiting of food with or without bile and pancreatic juice. It is extremely abundant, and the patient rejects much more than is swallowed. From the stomach with the tube large amounts of bile and pancreatic juice can be obtained. The passage of fæces and gas are infrequent, or completely absent. General meteorism of the epigastric region. Retraction of the subumbilical region.

3. *Ileo-jejunal Obstruction.*—Vomiting at first is mucus with food, mixed with bile, then consists of the contents of the upper part of the small intestine, becoming later fecaloid. Stools and gas almost totally absent. Distention is pronounced, occupying the middle portion of the

abdomen, the course of the colon being less distended or flat. May be visible peristalsis.

4. *Ileo-cæcal Occlusion.*—Vomiting more infrequent and coming on later than in the previous variety, and is fecal. Stools and flatus entirely absent. Distention the same as in the previous form and without pushing up of the liver or thoracic organs. Tenderness localized in the ileo-cæcal region, and, in most of the cases, tenderness of the right pelvic wall by rectal or vaginal examination.

5. *Occlusion at the Hepatic Flexure.*—Vomiting appears late, and is fecal; can entirely fail. Stool and flatus absent. Distention pronounced, particularly of the ascending colon, with pressing upward of the liver and diaphragm. Tenderness marked in the region of the hepatic flexure. High enemata are well retained. Tumor may be present.

6. *Occlusion at the Splenic Flexure.*—Vomiting much later, may be wanting. No passage of gas or fæces. Distention very marked, particularly of the transverse and ascending colon, producing pressure upward of the diaphragm. Tenderness most marked in the left hypochondrium. High enemata not so well retained. Tumor may be present.

7. *Obstruction at the Sigmoid.*—Vomiting very late or absent. No stool or gas passed. Meteorism very pronounced. Whole colon distended. Pushing upward of the liver and heart, resulting at times in the disappearance of the dulness of these organs. No high enemata possible. Low ones fairly retained. If obstruction be situated in the iliac part of the sigmoid, abdominal palpation may elicit it, in the pelvic portion rectal or vaginal examination may be necessary to determine it.

8. In colon obstruction as distinguished from ileo-cæcal, the large size of the tumor which may be present is to be noted, both palpable and percussible, and sometimes visible in its contour through the abdominal walls. In addition it is to be remarked that in the purely mechanical period there is usually no vomiting. This comes on when peritonitis sets in, *i.e.*, in the terminal stage. There are two methods which may help in the diagnosis of the seat of the occlusion when in the colon: 1. Insufflation of the colon with air producing tympanitic note and metallic tone in those points where it did not exist before. 2. Method of Treves of introducing water into the colon and progressively percussing the point of advancement of the fluid which will be arrested at the seat of obstruction.

THE LITERATURE AND UNPUBLISHED CASES.

In a paper published by Dr. Lucius W. Hotchkiss (*Annals of Surgery*, November, 1901) there are reported all the cases appearing in the records of the Transactions of the New York Surgical Society since 1893. In this series there were fifteen recoveries and six deaths. Dr. Ellsworth Eliot, Jr., in the *Medical News* of September 26, 1903, reports three cases, two recoveries and one death. At a meeting of the New York Surgical Society held December 9, 1903, three cases were reported. One by Dr. Hotchkiss followed several weeks after the appendicectomy, in which there was also a small abscess. In the successful operation for obstruction, an abscess was opened in the pelvis. This abscess had caused adhesions, which themselves had produced an angulation in the gut. Dr. Brewer reported a second successful case following a year after the original operation, the obstruction having lasted one week, where seven inches above the cæcum a band had caused a kinking of the intestines. The third successful case was operated upon by Dr. Willy Myer, eleven days after the original operation. In the second operation nothing was done but the opening of a secondary abscess. The adhesions about this abscess, or possibly the pressure alone of the abscess, had caused a kinking of the intestines.

Dr. R. H. Follis, Jr. (*Johns Hopkins Hospital Bulletin*, 1903, XIV, 86–88), reports operating for appendicitis abscess. After three days, obstruction developed, for which he performed an intestinal fistula. Patient did well for eighteen days, when a second obstruction developed, due to occlusion of another loop proximal to the site of the loop first opened. For this likewise a second fecal fistula was made. Normal bowel movements soon established themselves, and the two artificial ani eventually closed of themselves.

L. Bérard (*Bull. Med.*, Paris, 1902, XVI, 286–288) successfully operated on a case of obstruction seven years after an undoubted case of appendicitis, where he found many adhesions and a complex volvulus.

Otto Meyer, of Hamburg, reports in the *Deutsche Praxis München*, 1901, X, 412–414, operating upon an appendix abscess. A more or less general peritonitis ensued, resulting in what were thought to be a number of localized abscesses. Intestinal obstruction set in two weeks after the first operation, and on account of the patient's serious condi-

tion operation was not performed. In its place a needle was inserted into the dilated intestines six times in thirty-six hours, each time with relief of the obstruction. No operation was done and the patient made a perfect recovery.

A. M. Cartledge (*Louisville Monthly Journal of Medicine and Surgery*, 900, VII, 1–4) publishes a case illustrative of a different type than the preceding. Two days following the opening of an appendix abscess he had to make an artificial anus for intestinal obstruction. Three months later he operated to relieve this obstruction, and found the difficulty to be due to contracted adhesions which had narrowed the lumen to the size of a lead-pencil. In the discussion which followed the reading of this paper, Dr. W. C. Duncan said that he had had six cases of obstruction following within a few days after appendicitis operations. In all these he had made fecal fistulæ. Four out of the six died.

Broca writes a very interesting article, reporting six cases in the *Gaz. hebd. de Med. et Chir.*, 1901, XLVIII, 445–450. He divides the cases into two classes: First, those cases of appendicitis which develop obstruction before the original wound has healed—"early" obstruction; second, "tardy" obstruction; this suddenly appears after a period of perfect health of varying duration in a person who has already had an appendicitis, either suppurative or non-suppurative, previously operated upon or not. He cites three cases in each class, and comes to the conclusion that different operative measures are necessary in each class.

First class: Appendix abscess opened July 4, 1896, appendix not removed. Six weeks later, obstruction, preceded by progressive constipation, lasting four days; operated upon by median incision. Adherent band divided. No relief. Death followed. Autopsy revealed mass of adherent intestines, matted together, in the pelvis. Second case almost a counterpart of the preceding. Localized abscess opened December 9, 1899; appendix not removed. Fifteen days later gradually increasing obstruction. Operat on by median laparotomy showed multiple kinking in an adherent mass of intestines. Death. Autopsy in addition showed a small secondary abscess. In the third case a different method of procedure was employed. On February 6, 1900, an appendix abscess was opened, appendix not removed. Six weeks later obstruction developed. Median wound not made, but the original

wound was enlarged. Two openings were made in two adherent coils of intestines, but nothing but gas came out. Adhesions internally carefully separated and a band of omentum found to constrict intestines. Fæces then came through the fistulæ. Recovery. Two months later an attempt to close the fistulæ resulted fatally.

Second class of cases represents "tardy" obstruction, which comes on after a longer or shorter period of perfect health, following complete recovery from an appendicitis. The first case was operated upon in December, 1897, and a chronically inflamed appendix removed. Fecal fistula resulted, but closed spontaneously later. On July 1, 1898, operation for obstruction of three days' duration. Wound was reopened but nothing was found there. He then made median opening. A loop of small intestine was encountered, twisted into a **U**-shape by a double band in the mesenteric edge. This latter divided. Obstruction not relieved. Death. Autopsy showed an additional obstruction caused by a twisted loop of small intestine, adherent behind the ascending colon. The second case was operated on July 25, 1898, for a non-suppurative appendicitis. Quick convalescence. Well until February 19, 1899, when obstruction set in. Operation four days later. Median laparotomy. Band found compressing the ileum at its junction with cæcum. Obstruction seemed relieved, but patient died a few hours later of shock. The third patient had had, seven years previously, a severe attack of appendicitis which was treated medically and from which he recovered perfectly. July 7, 1900, he was seized very suddenly with all the symptoms of obstruction, for which he was operated on in twenty-four hours. Median laparotomy. Band found attached by one end to the intestine, and by the other to the pelvic wall, causing bending and compression of the loop, the two extremities of which were adherent. Division of the band and separation of the adhesions. A second compressing band was found in the right iliac fossa. Recovery. Broca comes to the conclusion from these cases, that cases belonging to the first category had better not be operated upon by a new median incision, but a distended loop of intestine searched for in the old wound, which, when found, should be opened, thus forming an artificial anus without opening the general peritoneal cavity. Later on, after many of the adhesions had become absorbed, the fistula could be closed, if it had not done so of itself. He thinks that the mortality would be much less by using this plan of pro-

cedure. In the "tardy" cases he unreservedly recommends a median incision below the navel.

J. B. Murphy (Chicago *Clinical Review*, 1895, V, 645) reports three cases all recovering after operation: 1. In August, 1895, he opened an appendix abscess, not removing the appendix. Subsequently the patient had several severe attacks of almost complete obstruction, for which he operated in April, 1896. He found the cæcum adherent to the abdominal wall. A loop of ileum had become wedged in between the cæcum and the abdominal wall, and was consequently much compressed. Recovery. 2. In December, 1894, he drained an appendix abscess. In February, 1895, he removed the appendix, following which the patient had four or five attacks each month of abdominal distention, vomiting, severe constipation, the attacks becoming gradually severer. In June, 1896, operation disclosed a loop of ileum bound down between the cæcum and small intestine, the part of the intestine proximal to the constriction being distended, the distal portion contracted. Recovery. 3. In June, 1895, a patient had a severe attack of appendicitis from which he was in bed four days. Following this he had several other attacks of the same difficulty. In January, 1896, after an attack of complete obstruction, he was operated upon. On separating a mass of adherent intestines there was found an almost completely flexed loop. Recovery.

Brunton (*Transactions of the Clinical Society*, London, 1893, XXVII, 196) reports a case of obstruction due to narrowing of the lumen, the result of recurring appendicitis. The patient had the first attack in May, 1892, followed by five attacks. The last one was in May, 1893. On September 1, 1893, appendicectomy. Twenty-four days thereafter he was operated upon for an obstruction of two days' duration, in which there was fecal vomiting. He found a mass of adhesions producing kinking of a loop. Recovery.

G. Marion (*Gazette des Hôpital*, Paris, 1900, p. 1439) has published an exhaustive article on the subject, reporting five cases, with one recovery. *Case I. Operation*, June, 1900, for an acute appendicitis. In September following, operation for obstruction, preceded for twelve days by obstinate constipation, for four days by total obstruction, and for twenty-four hours by fecal vomiting. Median laparotomy. Small intestine some distance from cæcum found much distended. Beyond this

point, near cæcum, intestine was collapsed. Between these two portions in the right iliac fossa was a mass of adherent small intestine folded and twisted on each other tightly. Recovery.—*Case II. Operation*, May 1, 1900. Gangrenous appendix, with general peritonitis. Thirteen days later symptoms of obstruction. Operation, May 17, 1900. Original wound opened. All the bowel found adherent, twisted, and compressed, with no possibility of their being liberated. Cæcum incised. This produced simply emptying of the cæcum itself. Incision in a coil of small intestine likewise produced only a limited evacuation of the contents of the immediate neighborhood. Autopsy showed practically the whole extent of the intestines agglutinated.—*Case III. Operation*, March 30, 1900, for appendicitis of two days' duration. April 11. Vaginal puncture for abscess in the cul-de-sac. April 21. Operation for obstruction of three days' standing. Findings: great mass of generally agglutinated intestines. Artificial anus made. Death. Autopsy showed the same unrelievable condition present as on operation. He here remarks that in many of these cases with a great mass of adherent bowel involving almost its whole extent, it is most difficult to decipher the exact cause as well as the exact site of the obstruction; it may be produced by tension, by bending, by strangulation, by volvulus, etc. These cases result from a general septic peritonitis, and an artificial anus seems the only resource. Another class of cases shows obstruction to be due to localized adhesions, illustrating which he cites two operations.—*Case* IV. This patient had had, a number of years before, an appendicitis, for which there had been no operation. In July, 1900, operation for obstruction of several days' duration. The small intestines were found plastered to the cæcum in an almost inextricable mass. Death.—*Case* V. This patient had had three antecedent attacks of appendicitis, the last one a month previously. Obstruction existed for four days. *Operation.* In cæcal region many dense adhesions. Artificial anus. Death. Autopsy showed in the mass of adherent intestines about the cæcum a volvulus absolutely constricting the bowel.

Dr. Samuel Lloyd has had four cases of obstruction occurring at varying intervals after a primary appendicitis operation, none within two weeks thereafter. All recovered after operation.—*Case I.* An intestinal coil was adherent to and wound about another loop so as to produce a constriction and total obstruction.—*Case II.* In this case

the omentum, forming part of the abscess-wall, was so tightly wound about a coil as to shut off the fecal circulation.—*Case III.* Gangrenous appendix removed. Three weeks after the primary operation, complete obstruction. Operation disclosed the fact that the adhesions in the wall of the old abscess had loosened up, and through the opening thus caused a loop of intestine had slipped, producing a strangulated hernia.—*Case IV.* Abscess alone opened at the primary operation. At a subsequent operation for obstruction, the appendix was found tightly wound about a coil and very adherent, producing obstruction at this point.

Dr. F. H. Markoe has had the three following unpublished cases: *Case I.* Male, aged forty. Operation in 1886 for perityphlitic abscess without removal of the appendix. In September 1894, operation for obstruction, due to adhesions binding the ileum to the old appendix site. Recovery.—*Case II.* Boy, aged eleven. Operation for acute suppurative appendicitis, September 14, 1889. One month later, operation for obstruction due to adhesions resulted fatally.—*Case III.* Girl; aged thirteen. Operation for suppurative appendicitis, November 29, 1895. Four days later an operation for obstruction resulted fatally.

Dr. Arthur L. Fisk operated upon a case of gangrenous appendicitis with a general peritonitis. Six days later a secondary abscess was opened. Twenty days after the first operation, acute obstruction. Operation disclosed complete kinks in two different places buried in a mass of adhesions. Recovery.

Dr. B. J. Lee gives me the following case: Interval appendix operation, June, 1903. No pus, but a few adhesions found. No drainage. Well until November 14, 1903, when he was seized with abdominal pains and vomiting. Large result from high enema. Obstructive symptoms then gradually developed. November 17, he had had no passage of fæces or gas for two days. Fecal vomiting set in and distention. Patient having previously refused operation, consented on November 17. Median incision. A band was found stretching from the mesentery, passing over the ileo-cæcal junction which it compressed, attaching itself to the abdominal wall. Behind this band a loop of ileum had wedged itself in. The large intestine was collapsed and the small much distended. After division of the band, gas passed onward into the collapsed intestine. Death in two days, apparently due to peritonitis, although the bowels had not acted after the operation.

Dr. L. W. Hotchkiss has operated upon these two unpublished cases: *Case I.* Male; aged two and a half. Operation, July 21, 1903, on the fifth day of the attack. Appendix found with gangrenous tip surrounded by a small abscess. A secondary abscess opened behind and above cæcum. Operation for obstruction, August 7, 1903. Median incision. Angulation found at the cæcum due to adhesions. Recovery.—*Case II.* This is a very interesting case of immediate obstruction. Male; aged twenty. Operation, November 14, 1903; acute gangrenous appendicitis with abscess and progredient peritonitis. On account of intractable vomiting, advancing sepsis, and no bowel movement, operation two days after the first operation. Median laparotomy. Some free, dark, foul fluid in peritoneal cavity. A mechanical obstruction was found, due to adherent band on right side producing a kink. Recovery from this procedure. Ten days later a second obstruction developed suddenly and was rapidly fatal without operation. In addition, both wounds were infected and patient was septic.

Dr. Robert Abbe has had five cases of obstruction following appendix operations. All recovered after operations for the obstructions.

Dr. Joseph A. Blake has kindly given me the following three interesting cases: *Case I.* M. A.; female; aged thirty-one. Operation for chronic appendicitis five weeks previously (operator unknown); no drainage. Obstruction had lasted five days. Operation disclosed the intestines obstructed in three places by fairly strong bands. Adhesive and purulent peritonitis in lower half of abdomen. Leakage of appendical stump. Death in forty-eight hours from sepsis.—*Case II.* J. T.; male; aged thirty-two. First operation January 8, 1901, for appendical abscess. Appendectomy and drainage (tube). Second operation February 21, 1901. Cœliotomy for a secondary abscess situated just below the liver, imbedded in a mass of adhesions. Drainage. The third operation was on March 26, 1901. Intestinal obstruction found, due to adhesion of loop of small intestine to abdominal wall, and a resulting volvulus. Resection of three inches of bowel and end-to-end union with Murphy button. Death on third day from peritonitis.—*Case III.* This case is one of acute intestinal obstruction due to bands, resulting from attacks of recurrent appendicitis without operation. At the time of operation patient was also suffering from appendicitis in the third day of the attack. C. A.; female; aged eighteen. Operation revealed the

appendix acutely inflamed, strictured, and distended, fresh adhesions. A loop of ileum, twelve inches long, found strangulated under a band (adhesion), and gangrenous. Appendectomy; resection of gut; end-to-end union with Murphy button. Recovery.

Dr. C. L. Gibson has reported to me this unpublished case. J. H.; aged eleven; operation August 13, 1902, for a first attack of appendicitis of three days' duration. There was a gangrenous appendix and free pus in all parts of the abdomen. Drainage was accomplished by an incision along the outer border of each rectus and a third in the epigastrium. Continuous irrigation was maintained for twenty-four hours. Marked improvement followed the operation, and patient was getting progressively better when on the ninth day vomiting and failure of bowel movement set in. Operation next day. Cæcum was found distended with fluid fæces. Source of the obstruction not sought for, an artificial anus being made in the cæcum. Temporary improvement, but death next day.

Kocher, in an article on ileus in general (*Mitteil. aus den Grenzgeb. der Med. und Chir.*, 1898, 227, Vol. IV), reports two cases of obstruction in patients who had had previously attacks of appendicitis unoperated upon, both due to bands from old adhesions. One patient had symptoms of obstruction for ten days, and gangrenous gut was found. This patient finally recovered, although convalescence was complicated with an abscess. The second case had a firm band binding the intestine so firmly as to completely obstruct its lumen. Recovery.

Dr. George E. Brewer has kindly furnished me with the following two unpublished cases: *Case I.* L. R.; aged thirteen. Acute appendicitis, with abscess fourteen months ago; convalescence delayed by prolonged suppuration. Admitted to Roosevelt Hospital November 3, 1903. Sickness began five days ago with umbilical pain, vomiting, and general weakness. Bowels moved once following enema. No flatus nor movement since. On admission, moderate distention, generalized tenderness; temperature 101°; pulse 120 and weak. Median incision six inches. Transverse colon collapsed and traced downward to right inguinal region, where a dense band was found passing from appendix stump to pelvic basin, beneath which was found about three inches of ileum. Constricted loop dark chocolate color. Bowel above this loop distended. Loop freed by division of band, stitched near sur-

face wound, injured intestine guarded by omental reinforcement. Wound closed with drainage. Recovery.—*Case II.* A. B.; aged twenty-seven. Has had six previous laparotomies: one for Cæsarean section one for acute appendicitis, one for ventral hernia, one for "abscess," and two for intestinal obstruction. Admitted November, 1903. Complained for one month of abdominal pain and slight distention with occasional vomiting. Bowels moved with difficulty. For past six days no movement or flatus. Very tender point to left of umbilicus; continuous vomiting. Temperature subnormal; pulse 130 and weak. Ten-inch incision to left of median line. Everything densely adherent. Three points of acute angulation found, one almost completely occluding lumen. Intestine distended above this point, collapse below. Adhesions separated and gut freed. A long rusty needle found penetrating omentum and transverse colon beneath point of greatest tenderness. Recovery uninterrupted.

Lapeyre, in the French Congress of Surgeons (*Revue de Chir.*, November, 1903, p. 608), reports three patients who had had a number of attacks of appendicitis previously, unoperated upon. All were subsequently operated upon for obstruction, from which one recovered.

Sonnenburg (*Centralblatt für Chir.*, No. 50, 1903, p. 1378), in the proceedings of the Berlin Surgical Society, reports ten cases of obstruction. In four cases it followed operations for appendicitis where pus was found, while in six cases obstruction followed operations done in the interval. In none, at the time of the second operation for obstruction, was there peritonitis present. The mortality is not reported.

Dr. Andrew J. McCosh reports elsewhere in this volume three cases of post-operative obstruction. All recovered from the operations for obstruction at his hands, one patient dying six months later, after an operation for obstruction, in a Western city.

Dr. John Rogers, Jr., kindly furnishes me with the following complicated case: Male; aged nineteen; operation for appendix abscess, September, 1902. After a hearty meal, September 29, 1903, sudden attack of "cramps." The next day began to vomit, passed some gas, but no fæces. The next three days continued to vomit bilious matter and passed no gas nor fæces. Seen by Dr. Rogers on October 3, 1903, for first time, when the only complaint was of the vomiting of yellowish-

green material. Enemata previously given had resulted in the passing of some foul, fecal-smelling, watery movements. Belly found soft and concave, with no tenderness anywhere. Temperature 101°; pulse 125. Expectant treatment for two days, in which the constipation and vomiting persisted. Operation, October 5, 1903. Median opening. Little or no intestinal distention. Exploration of the appendical region showed a dense fibrous band under which the intestine was tightly constricted. This band started from the ascending colon between it and the ileum, and passed up and back toward the spine, and was about two or three inches long. As it was divided, the upper and inner attachment was found to be the free border of the great omentum. The liberated gut when drawn out showed a transverse line of gangrene about one-quarter of an inch wide. The constricting band was so narrow that it had simply divided the gut transversely like a cord, so that very little trimming of the ends was necessary in order to make an end-to-end union with a Murphy button. The constriction was approximately eighteen inches down from the beginning of the jejunum. Recovery uneventful. Button passed on twenty-fifth day.

The total number of cases reported in this article is eighty-six. Of these, fifty-seven recovered after operations for the obstruction, and twenty-nine died, giving 66.3 per cent. of recoveries, and 33.7 per cent. of deaths.

Five cases had more than one attack of post-operative obstruction, *viz.*: Johnson's case (reported at New York Surgical Society, April 11, 1900) had three attacks; two operations for obstruction had been required within the year following the original operation for appendicitis, death resulting from a third attempt to relieve an obstruction which had developed in the course of the third year. McWilliams's first case in this article had two attacks, with recovery after operations. Hotchkiss's case had two attacks, the patient dying in the second attack without operation. Brewer's patient had three attacks, with recovery after three operations. McCosh's patient had two attacks, with death after the second operation for obstruction.

From this it is seen that .8 per cent. of those who had survived one attack of obstruction, suffered others.

The location of the obstruction was given in fifty of the cases. In every one it was situated in the small intestine. The cause of the ob-

struction was given in fifty-three cases, and they are as follows: Constrictions by bands in twenty-eight patients, volvuli in ten; kinkings, or angulations, in eleven; and internal herniæ in four cases. Gangrenous gut was encountered in five cases, necessitating resection, resulting in three recoveries and two deaths.

A fact to be noted is that obstruction occurred after the interval operation in eight cases. While no attempt was made to tabulate all the cases in the literature occurring in patients who had had no operation for attacks of appendicitis, it may be remarked that in this series there were nine such cases.

The time of the occurrence of the obstruction after the appendicitis, or after the operation for it, is given in fifty-four cases. It may be summarized as follows:

In first week, six cases; in second week, eight cases; in third week, eight cases; in fourth week, three cases; in fifth week, three cases; in sixth week, two cases; in seventh week, one case. From the third month to the twelfth, seven cases; between the first and second years, ten cases; between the second and third years, three cases; between the third and fourth year, one case.

One case occurred in the seventh year and one in the eighth year.

In concluding this report of cases, I wish to acknowledge my appreciation of the courtesy and generosity of the various surgeons who have so kindly furnished me with their cases, and to record my thanks to them all, collectively and individually.

It is noteworthy that in the innumerable operations for appendicitis, obstruction occurs so infrequently, and in the future we may expect a still smaller mortality from this complication, due to the earlier recognition of the original disease as well as the early operation for this complication at its inception before the development of gangrenous bowel or peritonitis.

Conclusions.—1. The rarity of intestinal obstruction in comparison with the innumerable operations for appendicitis is noteworthy.

2. Obstruction may follow an attack of appendicitis which has not been operated upon. Nine such cases occurred in this series of eighty-six cases, or ten per cent.

3. Obstruction may follow the "interval" operation. Eight cases, or nine per cent., belong to this category.

4. Obstruction is most apt to follow appendicitis with abscess formation. Sixty-nine, or eighty-one per cent., were of this class.

5. Mechanical obstruction may come on within a short time after the appendicitis operation, when the differential diagnosis from that due to peritonitis may present great difficulties. When in doubt, operate, for many patients have undoubtedly died unoperated upon, with an unrecognized mechanical obstruction (with or without peritonitis) where the erroneous diagnosis was made of simple, uncomplicated peritonitis.

6. Obstruction may occur years after the original attack, or operation (*e.g.*, ten cases occurred in the second year), when it may come on suddenly in perfect health, or preceded by a period with symptoms denoting "partial" (chronic) occlusion, the right interpretation of which symptoms, from a prophylactic standpoint, is of the greatest importance.

7. There may be several attacks of true, mechanical obstruction. In the above series of eighty-six cases, several attacks occurred in five, or .8 per cent. of the fifty-seven patients who survived the first operation for obstruction.

8. Of the eighty-six patients, fifty-seven, or 66.3 per cent., recovered after operations for obstructions. Twenty-nine patients, or 33.7 per cent., died.

9. The small intestine was occluded in all of the fifty cases where it was noted.

10. The cause of the obstruction was given in fifty-three cases as follows: Constrictions by bands in twenty-eight patients; volvuli in 10; kinkings, or angulations, in eleven; and internal herniæ in four cases.

11. Gangrenous bowel was encountered in five cases, necessitating resection, resulting in three recoveries and two deaths.

12. We may expect a much smaller death-rate in the future, due to the earlier recognition of the symptoms and their more prompt relief by operation. Fecal vomiting should not be waited for.

13. Prophylaxis consists in operating upon appendicitis before the formation of pus, and the use of as little drainage as possible.

14. Vigorous abdominal massage with elevation of the hips may avert an impending obstruction.

X.

A CONTRIBUTION TO CYTO-DIAGNOSIS IN PLEURAL EFFUSIONS, WITH ESPECIAL REFERENCE TO THE TUBERCULAR FORM.

By Herbert Swift Carter, M.D.

Cyto-diagnosis of pleural effusions is a subject which, until very recently, has been entirely ignored, although the cells of the blood, and those found in exudates from some other portions of the body, have long been studied and discussed. The extreme importance, to the patient, of a positive diagnosis in suspected tuberculosis anywhere, can scarcely be over-estimated, and the earlier the diagnosis the more favorable the result, as a rule; hence, when a patient with a pleural effusion is presented, a practically positive diagnosis of its etiology, *i.e.*, whether tubercular or not, offers the best chance for the individual's proper care. To emphasize this the more, according to Cabot[1] fifteen per cent. of 152 cases of pleurisy with effusion developed demonstrable tuberculosis of lung or bone, in three per cent. of which the tuberculosis manifested itself within two years of the date of the effusion. Since he used no positive method for determining which were tubercular and which non-tubercular, undoubtedly a considerable number of the latter were included among the observations, so that, proportionately, the number of cases which developed tuberculosis would probably be considerably greater had the non-tubercular cases been positively excluded from the series.

Widal and Ravant[2] were the first to call attention to a lymphocytosis in the so-called idiopathic pleurisies, but their conclusions, so far as the establishment of a positive diagnosis of their tubercular origin, are incomplete, as they took into account only the differential cell count, while as a matter of fact a more complete morphological examination of the effusion is necessary; and there are other diagnostic points, without which one cannot make a diagnosis of tubercular

pleurisy, especially the *specific gravity*, *fibrin*, and *albumin content*, all of which are of extreme importance. There are many cases in which the lymphocytes predominate, although they are in nowise tubercular, as shown by Series D.

Reasoning also by analogy, Hand [3] found that he was able to demonstrate tubercle bacilli in the spinal fluid from cases of tubercular meningitis, in practically every case. In these he also found a lymphocytosis, but in addition an albumin content as high as nine per cent., whereas the normal spinal fluid contains but about five-tenths per cent. and that of the ordinary meningitis four to five per cent.

The fluid from two cases of proven tubercular peritonitis was also examined and showed a lymphocytosis, one of 98.6 per cent., another of ninety-nine per cent., each with high fibrin and albumin percentages.

Runeberg[4] long ago demonstrated the great difference in the albumin content of exudates and transudates, the latter having but a small percentage as compared with the former; while it is a matter of common experience that the specific gravity of exudates exceeds that of transudates, so that one can almost positively state that a pleural fluid with a specific gravity over 1010 or 1012 is exudative, while that below is the result of transudation. Hence it is only by a combination of morphological data that we are able to arrive at a practically positive diagnosis of tubercular pleurisy, without animal inoculations, and that this can be done with what seems reasonable certainty, is the object of these observations.

Animal injections are, above all, too slow, and much valuable time is lost to the patient in waiting for results, three weeks being about the shortest time in which tubercles may be demonstrated, and then not with certainty, while guinea-pigs survive injections of tuberculous pleural fluid two to three months, when one often finds the tubercles well developed and cheesy. Taken in connection with the difficulties of the process and the failures, it is too uncertain to ever become generally useful, while a morphological examination can be easily and rapidly made, and the results, for the various forms of pleural effusion, are nearly uniformly constant.

The advantage, too, of differentiating *statim* the exudates due to tubercle bacilli and pneumococci by this morphological examination is evident, for the majority of cases of each begin in much the same way—

chill, pain in the side, and a high temperature, often 103° to 104° F.; and when one has to go entirely by the history it is often quite impossible to say whether the patient has had an initial pneumonia with subsequent fluid, or whether it has been an acute tubercular pleurisy from the start, *e.g.*, Series B, Case XIV. Many samples of fluid came marked with a clinical diagnosis which proved on further examination to be wrong.

By reference to the tabulated cases, one can see that only three of the positively tubercular and two of the probably tubercular cases were at all subject to rheumatism, and it is to be doubted if the rheumatic poison ever gives a true pleural effusion, although this is a time-honored theory, and there is nothing theoretically against such a possibility, Dopter [5] going so far as to describe the characteristics of rheumatic pleurisy; but Wolf [6] says that what were previously described as such are now known to be tubercular, in all probability; and certainly this series of cases seems to bear out that statement most emphatically.

True cases of septic pleurisies (empyæmata) are of no interest from a cyto-diagnostic point of view, for, like all pus, the polymorphonuclears predominate almost to the exclusion of all other forms, and the etiological diagnosis can, so far as we know, be made only by cultures.

METHOD OF MORPHOLOGICAL EXAMINATION OF PLEURAL FLUIDS.

Fluids should be examined as promptly after aspiration as possible —immediately after, while still warm and before the fibrin clot forms— if animal inoculations are to be made; for, judging from Hand's experience with spinal fluids, the tubercle bacilli, or their spores, are entangled in the fibrin, as he was able to find bacilli, in his cases, only in it and never in the fluid, no matter how treated.

The color, turbidity, specific gravity reaction, and relative albumin content are then obtained. The latter is quickly done by adding strong nitric acid, when a large amount of albumin comes down in the form of thick, curdy clots; a small amount either as a light flocculent precipitate or a simple turbidity. When the fluid cools, the presence or absence of a fibrin clot is noted. This is a gelatinous mass when seen fresh and undisturbed, but on agitation of the fluid collects into

a small opaque mass of more dense fibrin resembling that seen after whipping fresh blood.

The amount of fluid used successfully in inoculating guinea-pigs varied from 2 to 9 c.c., and the injection was made subcutaneously into the anterior chest-wall, under conditions as nearly aseptic as practicable.

To complete the examination, a conical tubeful of the fluid is then rapidly centrifuged for five minutes and the sediment stained on a cover-slip with Jenner's differential stain. A differential count is then made of the leucocytes; the endothelial cells, erythrocytes and general characters noted. In no instance were tubercle bacilli found in the fluid, although about one-half of the cases were examined for them. All the pleural fluids were either alkaline or neutral reaction, usually strong alkaline.

NOTE.—It will be seen, in looking over the cases, that sometimes there is no mention of the specific gravity or the fibrin or the albumin content. This is owing to the fact that in some of the earlier cases their importance was not recognized, and the results were originally to be based on subsequent histories of the cases after two to five years, so that sometimes only a differential count was made. The later cases were all routinely examined as detailed above.

OBSERVATIONS ON CASES OF PLEURITIC EFFUSION OF PROVEN TUBERCULAR ORIGIN.

Series A.

Case I.—Tapped twice. Thirty-two ounces. Highest temperature, 104° F.; average, 102° F. Fluid. Specific gravity, 1024. Fibrin, moderately large amount.

Lymphocytosis, on differential count:

	Per cent.
Small lymphocytes	92
Large mononuclears	7.2
Polymorphonuclears	.8
Eosinophiles	.0
	100.0

Result of guinea-pig inoculation: General tuberculosis in spleen, liver, lungs, glands. Tubercle bacilli in abundance.

Case II.—Tapped once. Thirty ounces. Highest temperature, 104.5° F.; average, 101.2° F. Fluid. Moderately large amount of fibrin.

Lymphocytosis, on differential count:

	Per cent.
Small lymphocytes	98
Large mononuclears	2
Polymorphonuclears	0
Eosinophiles	0
	100

Result of guinea-pig inoculation: Tubercles in spleen, liver, axillary and peritoneal glands; cheesy, tubercle bacilli in abundance.

Case III.—Tapped twice. Twenty-three ounces. Highest temperature, 105.5° F.; average, 101.5° F. Fluid. Specific gravity, 1012. Fibrin, moderately large amount. Albumin, large amount.

Lymphocytosis, on differential count:

	Per cent.
Small lymphocytes	90
Large mononuclears	1.7
Polymorphonuclears	7.7
Eosinophiles	.3
Basophiles	.3
	100.0

Result of autopsy: Acute miliary tuberculosis of both lungs, tubercular peritonitis.

Case IV.—Tapped twice. Sixty ounces. Highest temperature, 101° F.; average, 99.5° F. Fluid. Specific gravity, 1019. Fibrin, large amount. Albumin, large amount.

Lymphocytosis, on differential count:

	Per cent.
Small lymphocytes	100

Result of autopsy: Both pleuræ thickened; fresh tubercles on left pleura; old tubercular foci with cicatrization on right.

Case V. — Tapped once. Twenty-five ounces. Highest temperature, 104° F.; average, 101° F. Fluid. Specific gravity, 1014. Fibrin, large amount. Albumin, large amount.

Lymphocytosis, on differential count:

	Per cent.
Small lymphocytes	98
Large mononuclears	2
	100

Result of guinea-pig inoculation: Scattered miliary tubercles throughout both lungs and spleen; cheesy axillary glands.

Result of autopsy on patient: Miliary tubercles over both pleuræ and in both lungs; tubercular peritonitis and colitis.

Case VI.—Tapped once. Forty-eight ounces. Highest temperature, 100.5° F.; average, 98.4° F. Fluid. Specific gravity, 1022. Fibrin, moderate amount. Albumin, large amount.

Lymphocytosis, on differential count:

	Per cent.
Small lymphocytes	97.5
Large mononuclears	2.5
	100.0

Result of autopsy: Miliary tubercles on right pleura and scattered throughout the right lung. Had articular rheumatism five years ago.

Case VII.—Tapped twice. Forty-five ounces. Fluid. Specific gravity, 1022. Fibrin, large amount. Albumin, large amount.

Lymphocytosis, on differential count:

	Per cent.
Small lymphocytes	98.4
Large mononuclears	.3
Polymorphonuclears	1.3
	100.0

Result of autopsy: Miliary tubercles on right pleura and in right lung; extreme arterio-sclerosis with cardiac hypertrophy and dilatation; chronic myocarditis; chronic diffuse nephritis.

Case VIII.—Tapped once. Twenty-five ounces. Highest temperature, 102° F.; average, 100.4° F. Fluid. Specific gravity, 1022. Fibrin, large amount. Albumin, large amount.

Lymphocytosis, on differential count:

	Per cent.
Small lymphocytes	96
Large mononuclears	1
Polymorphonuclears	3
	100

Result of guinea-pig inoculation showed tuberculosis of lungs.

Case IX.—Tapped once. Forty ounces. Highest temperature, 104° F.; average, 101.5° F. Fluid. Specific gravity, 1012. Fibrin, large amount. Albumin, large amount.

Lymphocytosis, on differential count:

	Per cent.
Small lymphocytes	100
Large mononuclears	0
	100

Result of autopsy: Fluid in both pleural sacs; acute miliary tuberculosis, both lungs; chronic endocarditis, with marked cardiac hypertrophy and dilatation. Had articular rheumatism two years ago.

Case X.—Tapped three times. Forty-three ounces. Highest temperature, 104° F.; average, 101.1° F. Fluid. Fibrin and albumin in large amount.

Lymphocytosis on differential count:

	Per cent.
Small lymphocytes	100

Result of guinea-pig inoculation: Miliary tuberculosis of lungs and liver.

In looking over this series one is struck by the following facts: That, so far as examined, they show a fluid with a specific gravity over 1012, ranging from 1012 to 1024, with an average of 1018.3, a large or moderately large fibrin clot, and a large amount of albumin, besides a lymphocytosis from ninety to one hundred per cent., averaging 96.9 per cent. (Here and elsewhere a lymphocytosis refers to the small lymphocytes.)

The day of disease on which these cases were tapped varied from the 5th to the 42d as follows: 5th, 6th, 7th, 13th, 14th, 16th, 21st, 28th, 37th, and 42d, but not even in those examined during the first week was

there seen a polymorphonuclear leucocytosis, as is said often to be the case by Gulland [7], Wolf [6], Barjou and Cade [8], and Utichælis [9]. The nearest approach to this was seen in Case X, Series B. It would seem, however, from the observations of others, that a high polymorphonuclear leucocytosis might be found early, and subsequent differential counts be necessary to clear the diagnosis, although comparatively few cases need tapping much before the latter part of the first week, unless the fluid accumulates very rapidly.

The relative number of cells in the fluid appears of no importance, or at least their importance, if any, is not known, for in this series some cases showed a very large number of cells, and in others it was necessary to count an entire cover-slip in order to get fifty or a hundred for a diagnosis; this, too, after centrifugating. A point of interest is that, so far as noted, some of the cases showed the presence of few endothelial cells, and others of many, which is quite at variance with Dopter's [5] statement that "in tubercular pleurisy we find particularly an absence of endothelial cells." Nor is their presence a positive indication of an effusion of long duration, as they were found in abundance in Case XI on the sixth day.

The temperature curve in these cases of proven tubercular pleurisy is also of interest compared with the probably tubercular and post-pneumonic cases, the highest temperature recorded being 105.5° F., while the average highest was 103.2° F. The average range from admission to discharge being 100.7° F. (see Table of Averages), hence it is seen that the true tubercular cases show a tendency to high temperatures, particularly early in the disease, or until the fluid is at least in part removed.

The color of the fluids varied between a straw, amber, greenish, yellow or reddish tinge, the highest recorded amount of fluid obtained being forty-eight ounces, lowest twenty-three ounces, with an average of 32.6 ounces.

Two cases of especial value from the point of view of differential diagnosis, were Cases VII and IX.

Case VII was that of an old colored man with extreme arteriosclerosis, myocarditis and chronic nephritis, who from time to time had excessive attacks of contraction of the arteries, with asthma. He got up fluid in one side of his chest, and at first the natural supposition

was that it was a transudate, as he had been gradually failing. However, a diagnosis of tubercular pleurisy was made after a morphological examination of the fluid, as it showed the typical ear-marks of a tubercular effusion, and this was confirmed at autopsy, ten days later. Case IX was somewhat similar, although a marked endocarditis with failing compensation was the occasion for seeking hospital treatment. The mitral and aortic valves were much damaged, and the fluid which collected in both pleural sacs was supposed to be the result of his impaired circulation. Examination of the fluid showed it to be a tubercular process, this also being confirmed by autopsy.

OBSERVATION ON CASES OF PLEURITIC EFFUSION OF PROBABLE TUBERCULAR ORIGIN.

Series B.

Case I.—Tapped three times. Ninety-two ounces. Highest temperature, 102.4° F.; average, 100.8° F. Fluid fibrin, large amount.

Lymphocytosis, on differential count:

	Per cent.
Small lymphocytes	98.8
Large mononuclears	.7
Polymorphonuclears	.5
	100.0

Tubercle bacilli found in sputum.

Case II.—Tapped twice. Nineteen ounces. Highest temperature (in hospital twenty-five days after onset), 101.8° F.; average, 100° F. Fluid fibrin, large amount.

Lymphocytosis, on differential count:

	Per cent.
Small lymphocytes	98
Large mononuclears	2
	100

Case III.—Tapped twice. Thirty-four ounces. Highest temperature, 104.6° F.; average, 100.5° F. Fluid fibrin, large amount.

Lymphocytosis, on differential count:

	Per cent.
Small lymphocytes	95
Large mononuclears	2
Polymorphonuclears	3
	100

Gave good reaction to tuberculin 2 mgr.

Case IV.—Tapped twice. Fifty ounces. Highest temperature, 102.8° F.; average, 100° F. Fluid. Specific gravity, 1020. Fibrin, large amount.

Lymphocytosis, on differential count :

	Per cent.
Small lymphocytes	98.3
Large mononuclears	.3
Polymorphonuclears	1.4
Eosinophiles	.0
	100.0

Râles at right apex. Severe hæmoptysis. Had articular rheumatism fifteen years ago. Gave good reaction to tuberculin 2 mgr.

Case V.—Tapped twice. Forty-two ounces. Highest temperature, 102.2° F.; average, 100° F. Fluid. Specific gravity, 1020. Fibrin, large amount.

Lymphocytosis, on differential count:

	Per cent.
Small lymphocytes	98.6
Large mononuclears	1.2
Polymorphonuclears	.0
Eosinophiles	.2
	100.0

Gave good reaction to tuberculin 2 mgr.

Case VI.—Tapped once. Eighteen ounces. Highest temperature, 103.8° F.; average, 100° F. Fluid. Specific gravity, 1020. Fibrin, large amount.

Lymphocytosis, on differential count:

	Per cent.
Small lymphocytes	91.6
Large mononuclears	8.4
	100.0

Case VII.—Tapped four times. One hundred and fifty-two ounces. Highest temperature, 103.8° F.; average, 101.8° F. Fluid. Specific gravity, 1020. Fibrin, large amount.

Lymphocytosis, on differential count:

	Per cent.
Small lymphocytes	96
Large mononuclears	2
Polymorphonuclears	2
	100

Case VIII.—Tapped three times. Fifty-six ounces. Highest temperature, 103.4° F.; average, 99.5° F. Fluid. Specific gravity, 1024. Fibrin, large amount.

Lymphocytosis, on differential count:

	Per cent.
Small lymphocytes	100
Large mononuclears	0
	100

Case IX.—Tapped four times. One hundred and eighty-nine ounces. Highest temperature, 104.2° F.; average, 100.7° F. Fluid. Specific gravity, 1022. Fibrin, large amount.

Lymphocytosis, on differential count:

		Per cent.
Small lymphocytes		100

Patient had bloody expectoration.

Case X.—Tapped twice. Fifty-three ounces. Highest temperature, 103.6° F.; average, 102° F. Fluid. Specific gravity, 1018. Fibrin, large amount.

Lymphocytosis, on differential count:

		Per cent.
On the eleventh day.	Small lymphocytes	65.5
	Polymorphonuclears	34.5
		100.0
On the sixteenth day.	Small lymphocytes	97
	Polymorphonuclears	3
		100

Case XI.—Tapped once. About forty ounces. Highest temperature, 102° F.; average, 100° F. Fluid. Specific gravity, 1020. Fibrin and albumin, large amount.

Lymphocytosis, on differential count:

	Per cent.
Small lymphocytes	100

Case XII.—Tapped once. Twenty-three ounces. Highest temperature, 103.5° F.; average, 100.7° F. Fluid. Specific gravity, 1018. Fibrin and albumin in large amount.

Lymphocytosis, on differential count:

	Per cent.
Small lymphocytes	98.00
Large mononuclears	1.33
Polymorphonuclears	67
	100.00

Case XIII.—Tapped once. Fifty-two ounces. (Fluid in chest on discharge.) Highest temperature, 103° F.; average, 100.6° F. Fluid. Specific gravity, 1016. Fibrin and albumin in large amount.

Lymphocytosis, on differential count:

	Per cent.
Small lymphocytes	100

Patient has night sweats.

Case XIV.—Tapped once. Ten ounces. Highest temperature, 103° F.; average, 99.5° F. Fluid. Specific gravity, 1016. Fibrin and albumin in large amount.

Lymphocytosis, on differential count:

	Per cent.
Small lymphocytes	94
Large mononuclears	0
Polymorphonuclears	6
	100

Sent to laboratory for diagnosis.

Case XV.—Tapped once. Six ounces. Highest temperature, 102.2° F.; average, 99.6° F. Fluid. Specific gravity, 1015. Fibrin, moderate amount; albumin, large amount.

Lymphocytosis, on differential count:

	Per cent.
Small lymphocytes	84
Large mononuclears	3
Polymorphonuclears	10
Eosinophiles	0
Basophiles	3
	100

Gave good reaction to tuberculin 4 mgr.

Case XVI.—Tapped twice. Eighty-nine ounces. Highest temperature, 104.5° F.; average, 101.5° F. Fluid. Specific gravity, 1016. Fibrin and albumin, large amount.

Lymphocytosis, on differential count:

	Per cent.
Small lymphocytes	94.5
Large mononuclears	0.0
Polymorphonuclears	5.5
	100.0

Fine râles at right apex. Tubercle bacilli in sputum.

Case XVII.—Tapped once. Fifty-five ounces. Highest temperature, 102.5° F.; average, 100.2° F. Fluid. Specific gravity, 1024; albumin in large amount.

Lymphocytosis, on differential count:

	Per cent.
Small lymphocytes	95.0
Large mononuclears	4.0
Basophiles	1.0
	100.0

Fine râles at both apices of lungs. Moderate reaction to tuberculin 2 mgr.

Case XVIII.—Tapped three times. One hundred ounces. Highest temperature, 105° F.; average, 100° F. Fluid. Fibrin and albumin in large amount.

Lymphocytosis, on differential count:

	Per cent.
Small lymphocytes	96.5
Large mononuclears	0.0
Polymorphonuclears	3.5
	100.0

Had articular rheumatism five years ago.

Case XIX.—Tapped twice. Sixty-two ounces. Highest temperature, 101.8° F.; average, 100.2° F. Fluid. Fibrin and albumin in large amount.

Lymphocytosis, on differential count:

	Per cent.
Small lymphocytes	91.5
Large mononuclears	5.0
Polymorphonuclears	3.5
	100.0

Fine crepitant râles at left apex persisting for months.

Case XX.—Tapped four times. One hundred and fifty-nine ounces. Temperature about normal. Fluid. Specific gravity, 1016. Fibrin and albumin in large amount, reddish color.

Lymphocytosis, on differential count:

	Per cent.
Small lymphocytes	87.0
Large mononuclears	.5
Polymorphonuclears	12.5
	100.0

Although the patient had a chronic endocarditis, the effusion was probably a true exudation on account of its specific gravity, fibrin, and albumin content. Had articular rheumatism twenty years ago.

In the cases which are included among those of probable tubercular origin, one sees the marked similarity to those of proven tuberculosis, in the specific gravity, albumin, and fibrin content and in that each has a lymphocytosis. While some of them have points in their physical examination of the lungs—sputum, tuberculin reaction—and which stamp the effusion as almost surely of tubercular origin, *e.g.*, Cases I, IV, IX, XVI, XVII, the others are included in the series on account of their conforming more or less closely in the morphological examination of the fluid to those known to be tubercular. (Series A.)

The specific gravity of these effusions, where noted, ranged from 101.5 to 102.4, with an average of 1019.4. As compared with 1018.3 of Series A a very slight difference. The fibrin and albumin content,

wherever noted, was large, as was the case also in Series A; while the small lymphocytes ran from eighty-four to one hundred per cent. (omitting Case X, which showed 34.5 per cent. of polymorphonuclears on the eleventh day, while the small lymphocytes went up to ninety-seven per cent. on the sixteenth day), with an average of 96.1 per cent. as compared with 96.9 per cent. of Series A.

The amount of fluid withdrawn was from six to one hundred and fifty-nine ounces, averaging 53.2 ounces, which is a somewhat higher quantity as compared with the cases of proved tuberculosis.

So far as temperature is concerned in these cases, we find it from 105° F. to normal, but with an average highest temperature of 102.9° F., as compared with 103.2° of Series A, the average temperature for all from admission to discharge being 100.4°, or almost exactly that of the tubercular cases. (See Table of Comparisons.)

Following these comparisons, it is easily seen that the diagnostic points of Series A and B are for the most part almost identical, and offer good ground for making a fairly positive diagnosis of tubercular pleurisy in the cases of Series B. An odd fact is that in those cases in which the tubercular pleurisy was not terminal, the patients were in almost every instance attacked while in apparently robust health, many, if not quite the majority of them, never having been ill before.

OBSERVATIONS ON SEROUS PLEURITIC EFFUSIONS FOLLOWING LOBAR PNEUMONIA.

Series C.

Case I.—Tapped once. Thirty ounces. Ten days after defervescence. Highest temperature, 100.5° F.; average, 99° F. Fluid. Fibrin, large amount, clear amber. Polymorphonuclears in excess.

	Per cent.
Polymorphonuclears	58.6
Small lymphocytes	36.4
Large mononuclears	5.0
	100.0

Case II.—Tapped twice. Ten ounces. Highest temperature, 102° F.; average, 100° F. Fluid. Specific gravity, 1016. Albumin in large amount, straw amber. Polymorphonuclears in excess.

	Per cent.
Polymorphonuclears	75.6
Small lymphocytes	23.4
Eosinophiles	1.0
	100.0

Tapped seven days after end of pneumonia; temperature continued moderately elevated.

Case III.—Tapped once. Five ounces. Highest temperature, 100.2° F.; average, 99.5° F. Fluid. Specific gravity, 1016. Fibrin and albumin in large amount. Polymorphonuclears in excess.

	Per cent.
Polymorphonuclears	67.5
Small lymphocytes	28.5
Large mononuclears	4.0
	100.0

Tapped six days after defervescence; fluid looked like slightly diluted blood.

Case IV.—Tapped twice. Six ounces. Highest temperature, 105.2° F.; average, 103.2° F. Fluid. Specific gravity, 1015. Fibrin rather curdy, albumin fairly heavy amount. Polymorphonuclears in excess.

	Per cent.
Polymorphonuclears	92.5
Small lymphocytes	.5
Large mononuclears	7.0
	100.0

Fluid accumulated during course of long pneumonia.

Case V.—Fluid from operation unknown amount, bloody character. Highest temperature, 101.5° F.; average, 100.5° F. Fluid contained a fairly large blood clot. Polymorphonuclears in excess.

	Per cent.
Polymorphonuclears	78.0
Small lymphocytes	11.5
Large mononuclears	10.5
	100.0

Operation performed supposing it an empyæma; no morphological examination preceded. Microscopic examination showed diplococci which looked like pneumococci. No cultures made. Patient died. (Child.) No autopsy.

Case VI.—Tapped once. Thirty ounces. Highest temperature, 104° F.; average, 101.5 F. Fluid, green amber. Specific gravity, 1019. Fibrin and albumin in large amount. Polymorphonuclears in excess.

	Per cent.
Polymorphonuclears	71.2
Small lymphocytes	28.8
Large mononuclears	0.0
	100.0

Tapped on the fourth day of pneumonia; signs of consolidation persisted after the fluid was withdrawn and defervescence came normally.

This series is given as illustrating the points in differential diagnosis from the tubercular cases, which is accomplished principally by the differential cell count; as the color, specific gravity, albumin and fibrin content are much the same as one finds in the cases of tubercular origin, either proven or probable. When the differential cell counts are examined and compared with the other classes one sees an invariable polymorphonuclear leucocytosis ranging from 58.6 per cent. to 92.5 per cent., with an average of 71.7 per cent., even though the serum is often clear and corresponds in other respects to the tubercular effusions.

So far as the development of an empyæma is concerned, no prognostic value could be attached to the percentage of polymorphonuclears, as none of these cases developed it.

In examining the temperature curves, it is seen that when an effusion developed during the course of a pneumonia the temperature was that belonging to the original disease, and was high, as in Cases IV and VI; leaving these out of account we have a highest temperature from 100.2° F. to 102° F., with an average highest temperature of 101.5° F., which is much lower than that of Series A and B (see table); while the average for the entire series (again with the same two exceptions) is seen to be 99.7 per cent., which is also lower than that of either of the two preceding classes. While these cases are too few in number to formulate positive conclusions from, still it seems pretty certain that cases of

pneumonic serous effusion have a lower average temperature than tubercular cases, although there are exceptions at both ends of the scale.

The amount of fluid withdrawn, while not positively of diagnostic value, is of interest by comparison. The amount varied from five to thirty ounces, with an average of 18.5 ounces, or much below that of the tubercular cases.

Several samples of fluid were received with the diagnosis of tubercular pleurisy, which proved to have the characters of a post-pneumonic effusion.

OBSERVATIONS ON CASES OF PLEURAL TRANSUDATES.

SERIES D.

TRANSUDATES.

Diagnosis.	Color of Fluid.	Specific Gravity.	Fibrin.	Albumin.	Differential Count.	Small Lymphocytes. Per Cent.	Large Mononuclears. Per Cent.	Polymorphonuclears. Per Cent.	Eosinophiles. Per Cent.	Basophiles. Per Cent.	Notes.
Chronic Nephritis	Straw Yellow	1010	Slight	Small, Flocculent	Lymphocytosis	100	0	0	0	0	Temp., 97° to 100° F.
Same	Pale Gray	1007	None	Small, Flocculent	Lymphocytosis	86	0	9	4	1	Temp., 98° to 100° F.
Chronic Endocarditis	Yellow Amber	1010	None	Small, Flocculent	Lymphocytosis	98	1	1	0	0	——
Cardiac dilatation with acute pericarditis	Yellow	1008	None	Small, Flocculent	Lymphocytosis	99	0	1	0	0	Temp., 97° to 104.7 from acute pericarditis
Cardiac dilatation and hypertrophy	Yellow	1008	Slight	Small, Flocculent	Lymphocytosis	92	8	0	0	0	Temp., 98° to 100° F.

The interest in this class of cases is twofold: First, as illustrating the differential points between a transudate and an exudate, the former having a low specific gravity, average 1008.6 for these cases, a small amount of fibrin, or none at all, and a small amount of albumin, which appears simply as a cloudiness of the fluid or at most as a light, flocculent

precipitate on adding strong nitric acid. Second, in that the transudates all show a *positive lymphocytosis*—eighty-six to one hundred per cent., showing the fallacy of what has already been said, of basing a diagnosis of tubercular pleurisy on the differential count simply, as has been done by Dopter,[5] while Guilland [7] lays stress on the presence of large numbers of endothelial cells as a diagnostic point in transudates, also fallacious, as shown by reference to Series A and B, where large numbers of endothelial cells were frequently seen.

Among the various pleural fluids examined there were two cases resulting from pistol-shot wounds of the chest-walls which gave a marked eosinophilia—one of 70.2 per cent., the other 87.8 per cent. of eosinophiles. The significance of this is not known, and although Widal and Revant [2] report three cases somewhat similar, the eosinophiles running from fourteen to fifty-four per cent., they offer no explanation, and these cases are reported merely as curiosities.

TABLE OF AVERAGES FOR COMPARISON.

Form of Pleural Fluid.	Specific Gravity.	Amount of Fibrin.	Amount of Albumin.	Differential Count.	Temperature.		Amount of Fluid.
					Average Highest.	General Average.	
Proven tubercular	1018.3	Large	Large	Lymphocytosis, 96.9 per cent.	103.2° F.	100.7° F.	32.6 oz.
Probably tubercular.....	1019.4	Large	Large	Lymphocytosis, 96.1 per cent.	102.9° F.	100.4° F.	53.2 oz.
Post-pneumonic	1016.5	Large	Large	Polymorphonuclears, 71.7 per cent.	101° F.	99.7° F.	18.5 oz.
Transudates	1008.6	None or Small	Small	Lymphocytosis, 95 per cent.	?	?	?

CONCLUSIONS.

While, of course, these cases are too few in number to draw positive conclusions from, the results, as outlined, are at least extremely suggestive, and, so far as one can see, the uniformity of the analyses in the various series of cases seems to justify the following tentative conclusions:

First, that a true pleural effusion has a specific gravity over 1010, usually much higher, with an average of about 1017.9; a high fibrin and albumin content.

Second, a pleural transudate has a low specific gravity, with an average of about 1008; a small fibrin and albumin content.

Third, an almost certain diagnosis of tubercular pleurisy can be made by the morphological examination of the fluid alone, and rests on its having a high specific gravity—1012 to 1024, average 1018.6; a large amount of fibrin and albumin, with an accompanying lymphocytosis. There is usually a considerable rise of temperature at the outset, which may average 103.4° F.

Fourth, according to some authorities, one may find a polymorphonuclear leucocytosis before the third or fourth day of a tubercular pleurisy; in which case, subsequent examinations will be necessary to establish a positive diagnosis.

Fifth, a diagnosis of post-pneumonic serous effusion lies in its high specific gravity, averaging 1016.5; large fibrin and albumin content, with a polymorphonuclear leucocytosis, 58 to 92.5 per cent., averaging 71.7 per cent. The temperature is usually much lower than in the tubercular cases, unless complicating an active pneumonia, averaging at the outset about 101° F.

Sixth, a differential diagnosis between a pleural transudate and a tubercular pleurisy cannot rest alone on a differential cell count, as they both show a lymphocytosis, but must rest on a more complete examination, including the specific gravity and the amount of fibrin and albumin, as already shown and explained.

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XI.

AN UNUSUAL CASE OF FUNGATING BROMIDE OF POTASSIUM ERUPTION.

By A. F. Büchler, M.D.

Though efflorescences of erythematous, urticarial, and bullous character have repeatedly been observed to follow the ingestion of the bromides, yet the discrete papulo-pustule must be regarded as the prototype of this eruption.

Occasionally, however, by aggregation of this primary lesion into clusters or patches, and the supervention of infiltrative and proliferative changes at their base, deviations from this type are induced. These, though they may vary greatly in configuration among themselves, and thereby impart to the cutaneous manifestations the impress of polymorphism, yet represent but phases of evolution of the primary papulo-pustule.

A case well illustrating these variants, culminating in the development of a fungoid mass of unusual proportions, was seen at the Skin Clinic of the Out-Patient Department of the Presbyterian Hospital. Owing to its comparative rarity, it was deemed to possess sufficient interest to merit its depiction and warrant its publication.

The patient, a girl eleven years of age, was first seen on September 4, 1903. At that time the following condition of the skin was noted.

The patient is the bearer of a polymorphous eruption consisting of the following components:

1. Discrete papulo-pustules, with a narrow inflammatory zone, varying in size from a pin's head to that of a lentil; these are scattered over face, arms and legs.

2. Clusters of such papulo-pustules.

3. Clusters of papulo-pustules on an infiltrated base of brownish-red color.

4. Aggregations of papulo-pustules into large patches, with simple inflammatory base, about the size of a child's palm. These are sym-

metrically distributed over the extensor surface of each arm immediately above the elbow. Portions of these are covered by crusts.

5. Flat, rather firm excrescences of discoid and irregular shape on which the epithelium has been raised by a turbid fluid exudate to the formation of flabby bullæ. These are located in the middle of the tibial region of the left leg.

6. A tenser bulla on a simple inflammatory base; on inner aspect of right leg.

7. Tuberous, oval excrescence about one inch in length and one-half inch in breadth, on posterior surface of left leg. It presents several small follicular openings. From this a smegma-like smear can be expressed.

8. Fungoid mass. (See photograph.) This involves the tibial aspect of the right leg; it measures six inches in length and three inches in breadth; it is elevated about half an inch above the surrounding skin; it is soft and boggy; it emits an offensively rancid odor. Its base is of brownish-red color. Its surface is very irregular, partly presenting a granular papillomatous appearance, and partly covered by a firmly adherent greenish-black smear; finally, it presents conglomerations of pustules; these are well marked at its inner and lower portions, and clearly indicate the development of the mass by coalescence of conglomerated patches.

Concerning the previous history of the patient, it was ascertained that she is epileptic. These seizures date back to October, 1902; they were well controlled by her family physician by moderate doses of bromide of potassium. A trivial acne was an occasional accompaniment of this medication. She was then put upon a course of peptomanganate of iron. Toward the end of July and up to the time when first seen she took a proprietary medicine. A thorough analysis subsequently made by Mr. Alfred L. Freligh, the pharmacist of the Hospital, showed that this contained bromide of potassium in the proportion of eighty grains to the fluid ounce. The daily dose, taken for a period of six weeks, approximately estimated, was between thirty and forty grains. Within the first week a papulo-pustular eruption appeared on face, then on arms and legs. Many of the lesions soon coalesced and enlarged until they assumed the proportions indicated above. On discontinuing the mixture and under dressings of solutions and oint-

An unusual case of fungating bromide of potassium eruption.

ments of boracic acid, all of them underwent gradual involution. This was practically completed by October 10th, brownish-red pigmentary stains marking the former site of the affection.

The fungating bromide eruption is indeed very uncommon. Cases of this description have been published by Seguin,[1] Taylor,[2] G. T. Elliot,[3] Wallbaum,[4] Horrocks,[5] Szadek,[6] Haslund,[7] Pini,[8] and others. The two cases reported by Jackson[9] were apparently of minor degree.

The writer's personal experience is limited to four cases. For the opportunity of seeing three of these he is indebted to the courtesy of Dr. Forbes Hawkes, Dr. Max G. Schlapp, and the late Dr. R. S. Newton. The fourth is the one here recorded.

All of the patients were seen at the Out-Patient Department; all were epileptic; in all, the tibial region was the part mainly involved.

The recognition of this affection is of no small importance. In the oft-cited case of Koebner, amputation of the leg had been contemplated; in that of Szadek, the eruption was interpreted by several experienced dermatologists as an exquisite example of tuberous syphilis, and the patient subjected to the most vigorous anti-syphilitic treatment for three years.

Pini reports in his case an eosinophilia of ten per cent. A blood-count made in our case by Dr. J. W. Coe, in the declining stage of the eruption, gave a percentage of three.

Hartzell[10] has pointed to the association of severe bromide eruptions with valvular disease of the heart. In our case no such association was found.

In conclusion, the writer begs to express his sincere thanks to Mr. I. L. Simms for the excellent photograph accompanying this article, which well illustrates such stages of the affection as occurred on the tibial aspect of the legs.

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XII.

A REPORT OF THIRTEEN CASES OF TUBERCULOUS AXILLARY ADENITIS.

By Burton J. Lee, M.D.

During the period between July 1, 1896, and July 1, 1903, there have occurred in the wards of the Presbyterian Hospital eleven cases of tuberculous axillary lymph-nodes requiring surgical interference, the diagnosis being verified by a microscopical examination of the glands removed. In addition, two instances of the same disease, seen in private practice, are included. Three further cases where the axillary involvement was not sufficient to warrant operation, although the cervical glands excised were tuberculous, are not included, because no pathological report upon the axillary nodes can be given. It is unfortunate that a large number of patients with an apparent tuberculosis of the axillary lymph-nodes, primary or secondary to cervical or pulmonary disease, cannot be reported because no record has been made of any pathological finding. The literature on the subject is meagre, and this is surprising, for it is not an uncommon manifestation of tuberculosis. Erickson, in 1856, however, reported a case of primary tuberculous axillary adenitis in a young woman twenty-two years of age. Treves, in 1882, in his monograph on scrofula, confines his attention solely to the cervical glands. Very few of the standard text-books on surgery even mention the subject, and then usually as an associated lesion with cervical glandular disease.

ETIOLOGY.

Hereditary Predisposition.—But two of the thirteen cases gave any history of family tuberculosis, and in each of the two instances (Cases III and IX) the relatives affected were an aunt and uncle on the mother's side. In no case was there any tuberculosis of the immediate family.

Age.—The ages varied from fifteen to fifty-six; the average of those

affected being 29.6 years. This is considerably higher than in cervical disease, and a larger group of cases of glandular tuberculosis of the axilla may show an average considerably below this.

Sex.—Five were females and eight males, making 37.5 per cent. of the former and 62.5 per cent. of the latter.

Relation to Tuberculous Cervical Adenitis.—It is often stated that most examples of axillary adenitis of tuberculous origin are secondary to an affection of the neck glands. Parker reports 145 cases of tuberculous cervical adenitis with the axillary glands involved in thirteen, a proportion of 8.96 per cent. of axillary disease in cervical cases. Mitchell states that of 143 examples of tuberculosis of cervical lymph-nodes, seven had a secondary focus in the axillary glands, a ratio of 4.87 per cent. Dowd says that in rapidly progressive cases of cervical tuberculous lymph-nodes the axillary glands soon became involved. An examination of our group of thirteen shows but five (Cases I, II, III, V, and VII) which had any pre-existing tuberculosis of the cervical lymph-glands.

During the seven years covered in this report, there occurred in the Presbyterian Hospital sixty-seven cases of tuberculous cervical adenitis, verified by pathological report. There was then a secondary infection in the axillary lymph-nodes in but 7.46 per cent. of the cervical cases. a fact worthy of considerable notice. The axillary condition developed at a period varying from six and one-half to thirteen months after the first note was made of primary cervical disease, an average time of about ten months. Of the remaining eight cases in our series, it is an interesting fact that five (Cases IV, IX, X, XI, and XII) were apparently primary in the axillary glands, there being no pulmonary or cervical tuberculosis. Two of these cases developed tuberculous cervical lymph-nodes about two years after notice was first taken of the axillary condition. During the past seven years at this hospital, the comparative frequency of tuberculous adenitis in the axilla and neck has been as eleven is to sixty-seven, a ratio of 16.42 per cent. for axillary and 83.58 per cent. for cervical. This is a somewhat lower figure than given by Mitchell, who claims that ninety per cent. of all tuberculous glands are situated in the cervical region.

Relation to Pulmonary Tuberculosis.—Four of the patients (Cases I, II, VI, and VIII) had an associated tuberculosis of the lungs at

the time of first observation. An additional case (XIII) had suffered from pleurisy with effusion about seven months prior to the beginning of axillary disease, but has never developed any pulmonary affection. Two of the four cases (I and II) had also a cervical adenitis accompanying the pulmonary lesion. The proportion, then, with a lung lesion before the inception of axillary disease was as four is to thirteen, or 30.77 per cent. Cases III and IX later developed disease of the lungs; the first, one year after cervical glands were noticed, and about one month following the axillary involvement; the latter, about three years after beginning of disease in the axilla, and one year from the inception of disease in the neck. Holt and Treves affirm that few examples of tuberculous cervical adenitis develop general tuberculosis. Mitchell says that in nineteen per cent. of cases of tuberculosis of cervical lymph-nodes the lungs are tuberculous. This is considerably lower than in the present series, where ultimately six of the thirteen, or 46.15 per cent., were afflicted with pulmonary tuberculosis. In all six cases the cervical glands were affected, and it is of interest to note that no case, with axillary involvement alone, developed any pulmonary symptoms. It is regretted that, with the exception of Cases XII and XIII, whose lungs were found normal, it has been impossible to examine at a recent date any of the remaining cases of this report.

Relation to Simple Injection of the Upper Extremity.—In two instances (Cases X and XIII) it is interesting to report that an acute infection in a finger was followed by an axillary adenitis, in the first case with a history of but sixteen days from the time of initial infection in the finger to the date of excision of the lymph-nodes; in the second, a period of about four months. In both examples the pathological report pronounced the glands tuberculous. In Case X no pulmonary lesion was present as a possible cause. In Case XIII, however, the patient had been treated for pleurisy with effusion about seven months before, but had never had a pulmonary lesion.

Additional Causes.—Case IV, although without any infection in gland tissue, is included in this report because of its rather unusual character. A cyst with a tuberculous sac was found in the posterior portion of the axilla, invading the muscles. Exciting cause of cyst unknown.

Case VIII was a sufferer from pulmonary tuberculosis, with tubercu-

lous sterno-clavicular disease and secondary involvement of the axillary lymph-nodes.

In Cases XI and XII no exciting cause of axillary disease can be found.

There are no examples in this series of any axillary infection secondary to tuberculous mastitis.

ANATOMY AND PATHOLOGY.

Anatomy.—As described by Kirmisson, there are three divisions of the axillary lymph-nodes: 1. Superficial anterior—along the lower border of the pectoralis major muscle, receiving the lymphatics from the arm and mamma. 2. Superficial superior—along the anterior margin of the latissimus dorsi muscle, receiving lymphatics from the scapular region and posterior part of the axilla. 3. Deep glands—along the axillary vein, which, according to Gould, send afferent vessels into the supraclavicular glands, and, as will be seen later in a study of Case I, efferent channels from the cervical to the infraclavicular glands. Levy apparently divides 3 into (*a*) Pectoral—one or more small glands, on the inner side of the axillary vein, behind the pectoralis minor; and (*b*) Infraclavicular—a few small nodes on the serratus magnus, just below the clavicle, on the inner side of the axillary vein. He also describes several other inconstant groups: 1. A few about the beginning of the subscapular vein. 2. A few along the lower border of the pectoralis minor. 3. One or two between the two pectoral muscles. 4. A cephalic gland in the interval between the pectoralis major and the deltoid. Gulland states that in the cervical region there may be a continuous chain of lymph-nodes, from one side to the other, low down in the neck. Considering the lymphatic connection which exists between the supraclavicular and infraclavicular glands, it is not surprising that a cervical infection on one side may accompany an axillary involvement on the other. Of the seven cases in our report, with cervical lymphatic disease, but one (Case I) illustrated the possibility of this crossed infection, the right axillary lymph-nodes being infected eight months after the inception of disease in the left cervical region. Gulland also affirms that the lower cervical nodes are connected with the thoracic as well as to the axillary glands, but I have been unable to find any definite description of lymphatic connection between

the axillary and thoracic glands. This is probably indirectly through the lower cervical chain.

Gross Pathology.—Cheyne, in discussing the pathology of tuberculous lymph-glands, mentions five varieties:

(*a*) Small and hard, but not large enough for deformity.

(*b*) Steady enlargement, with the axilla frequently involved.

(*c*) Suppuration.

(*d*) One or more small unopened abscesses.

(*e*) Periadenitis—mentioned additionally by Mitchell.

In this report the following groups of cases may be distinguished:

(*a*) Hypertrophy, without cheesy degeneration—one example—the axillary nodes having been enlarged for about four months.

(*b*) Cheesy degeneration—six instances—differing considerably in degree and in length of time from apparent date of infection.

(*c*) Abscess formation—three cases; one with a large abscess, the other two with many small miliary abscesses following a superficial abscess some months before. In both of the latter cases some cheesy degeneration was also present.

(*d*) Sinus formation—two examples—following previous operations, with incomplete removal of infected lymph-nodes.

(*e*) Cyst—showing tuberculous inflammation invading muscle.

(*f*) Periadenitis was present in all the advanced cases. The microscopical pathology of the glands has been omitted in this discussion.

Case I.—C. K., aged twenty-six; married; housewife.

History.—Patient was admitted to hospital April 26, discharged May 6, 1898; service of Dr. McCosh. No family tuberculous history. Is being treated at the Presbyterian Dispensary for pulmonary tuberculosis. Was in the hospital three years ago for gastric ulcer with hæmatemesis, the last hæmorrhage occurring about eight months ago. Since that time has noticed a swelling below *left* angle of jaw, which was painful at first, and has been growing rapidly. Two months ago an operation was performed at Vanderbilt clinic upon mass mentioned. Swelling has reappeared again lately but is not painful. Has also noticed a lump in right axilla for a few weeks. Is not losing flesh or strength.

Physical Examination.—Several enlarged glands in left posterior cervical region, one being size of walnut; distinct and freely movable.

A few enlarged glands in right axilla. Pulse, 80; respiration, 18; temperature, 98° on admission.

Operation, April 28 (Dr. McCosh).—Incision from left mastoid process to within two inches above centre of clavicle. Several small, cheesy lymph-nodes removed from beneath sterno-mastoid, which was partially divided; wound drained. Few enlarged glands removed from right axilla through an incision in its lower part. No drainage. Recovery uneventful.

Pathological Report (Dr. Thacher).—Typical tubercular inflammation.

Subsequent History.—Returned to hospital December 8, discharged December 23, 1898. Recurrence in left side of neck two months ago, with suppuration and appearance of several glandular masses.

A *physical examination* showed a moderate infiltration of the right apex. Few small glands in left side of neck; right axilla clear. A thorough operation was performed by Dr. McCosh and several glandular masses removed. Few tubercle bacilli in sputum.

Microscopical examination of lymph-nodes showed typical tubercles with large cheesy masses (Dr. Thacher).

Case II.—T. M., aged fifty-four; married; engineer; Ireland.

History.—Patient was admitted to hospital May 9; discharged May 24, 1898; service of Dr. McCosh. No family tuberculous history. Patient well until one year ago. Admits a chancre many years back. Has had a cough with night-sweats for past eighteen months, but without hæmoptysis or loss of weight. About fifteen months ago he first noticed an enlargement of the left cervical glands, and three months later a portion of the glands were removed at a hospital, leaving a discharging sinus which still persists. About seven months back a second operation was performed at same institution and a discharging sinus still remains. Two months ago he noticed a slight swelling of the right cervical region, also an enlargement of glands in both axillæ, and a mass over the sternum.

Physical Examination.—Very many discharging sinuses with remnants of broken-down lymph-nodes in axilla and on both sides of the neck. Lungs negative. Pulse, 68; respiration, 20; temperature, 97° on admission.

Operation, May 13 (Dr. McCosh).—Several large glands removed

from both axillæ. Both sides curetted and partial excision performed. Drainage of iodoform gauze. Normal recovery.

Pathological Report (Dr. Thacher).—Microscopical examination: tubercular inflammation.

Case III.—J. E., aged twenty-three; single; painter.

History.—Patient admitted to hospital March 22; discharged March 28, 1899; service of Dr. McCosh. Patient was operated upon four months ago at Presbyterian Hospital, for extensive right cervical adenitis, by Dr. McCosh. Both parents healthy, but aunt, grand-uncle and grand-aunt, all on mother's side, died of consumption. He had measles and scarlet fever in childhood. Has not been well during the past two years. Patient had noticed, prior to operation, a swelling in right side of neck for one year. There had been a supraclavicular swelling for about three months. At the operation an extensive dissection was practised down to vessels in right cervical region. Gauze drainage.

A *physical examination* at that time revealed a large mass in right cervical region and a few small glands in right axilla.

The *Pathological Report* (by Dr. Thacher) showed tubercular inflammation.

Three weeks before he had noticed a small lump in the right axilla with little pain and slight enlargement. By examination all glands in right axilla were found much enlarged and adherent. One small mass was palpable on the right side of neck.

Operation, March 23 (Dr. McCosh).—Glands and fat in right axilla dissected free from vessels and excised, mass being size of a hen's egg. Drain of iodoform gauze. Cervical gland additionally excised.

Pathological Report.—Tubercular inflammation (Dr. Thacher).

Subsequent History.—From April 3 to April 10, 1900, patient was again in hospital. Had been in splendid health and good weight till two months ago; then noticed a small swelling in right cervical region, a few masses in left.

Physical examination showed dulness with diminished breathing over left apex. Several enlarged glands in right side of neck; axilla clear. Glands were removed on both sides of neck.

On June 24, 1901, patient returned again. Recurrence in neck during past six months.

Physical examination showed well-marked signs in both apices. Mass of glands over right side of neck. No mention made of any axillary enlargement. A large mass was excised from the right cervical region.

Case IV.—M. L., aged twenty-nine; single; domestic.

History.—Patient was admitted to hospital March 13, 1899; discharged March 24, 1899; service of Dr. McCosh. Family negative to tuberculosis; patient always healthy. Three months before began with severe and sharp pain below and on outside of right breast. Pains were darting, and she was treated for pleurisy and neuralgia, receiving some relief from fly-blisters. Six weeks ago patient noticed a small, tender swelling in right axilla, which has been steadily enlarging and is still painful on pressure. Patient otherwise perfectly well.

Physical Examination.—She is well nourished; not anæmic; lungs negative. In right posterior axillary line, over eighth and ninth ribs, is a small mass size of an egg, not fluctuating, rather soft, not painful; apparently attached to ribs.

Operation, March 14, by Dr. McCosh.—Oblique incision over tumor mass, which seemed like sarcomatous tissue growing in muscles of chest wall. Partially excised and piece sent for microscopical examination.

Pathological Report.—Seems to be a cyst, with polypoid projections from the inner wall. Microscopical examination shows tubercular inflammation invading the muscles.

Case V.—J. S., aged sixteen; United States; errand boy.

History.—Patient admitted to hospital October 15, 1899; discharged November 3, 1899; service of Dr. McCosh. No family history of tuberculosis. In 1896 patient first noticed a few small lumps on the left side of neck in submaxillary region. An operation was performed, and a large number of glands along anterior border of sterno-mastoid removed. For one and a half years he has had enlarged glands on *right* side of neck, and for past two weeks has noticed some small masses in *left* axilla. He has had a slight cough for some years, but without expectoration or loss of flesh.

Physical Examination.—Lungs are normal. There are several small swellings in left axilla; sensitive, softened, probably broken-down glands. Cervical lymph-nodes on right side also enlarged.

Operation, by Dr. McCosh, October 26. An irregular mass of glands removed from left axilla, extending deeply up under the pectoral muscle, making necessary a partial division of this muscle. Then through another incision along the anterior border of the sterno-mastoid, another mass of glands was dissected out.

Pathological Report (Dr. Thacher).—Gross examination: Numerous large lymph-nodes containing many yellowish and grayish spots. Microscopical examination: Specimens examined from seven different parts; in one of these a few spots which looked rather like tubercles. Necrotic centres; radiating cells around, some imperfect giant cells within. In some of the other sections there are not any appearances suggesting tuberculosis.

Subsequent History.—Patient returned to Presbyterian Hospital January 15, 1900; discharged January 26, 1900. About one year ago he noticed a swelling behind right sterno-mastoid, not painful or tender; no increase in size of mass since first noticed.

On physical examination, patient well nourished; not anæmic. Lungs normal. There is a scar in left axilla; no masses felt there. *Right* side of neck presents scars of previous operations; at posterior border of right sterno-mastoid is a small lump, apparently an enlarged gland. In *right* axilla are a few small enlarged glands; both inguinal chains slightly palpable.

Operation, by Dr. McCosh, January 16.—Right cervical region, two incisions, one in front, the other along the posterior border of sterno-mastoid. In front, an enlarged lymph-node the size of a pigeon's egg was removed; behind, a mass of glands the size of a hen's egg, each individual gland ranging in size from a pea to a pigeon's egg. In dissection several lymph-nodes were broken and pus escaped. The wound was drained.

Pathological Report (Dr. Thacher).—Several cheesy nodules. Microscopical examination: tuberculous inflammation.

Patient returned again to the hospital April 23, 1901; discharged April 29, 1901. One week before admission was told that neck was again swelling, and on palpation he found several large nodes along the right cervical chains. No loss of flesh or strength. No night-sweats.

Physical examination showed him to be well nourished, not anæmic,

and that lungs were normal, with scars on right side of neck and some enlarged glands in right submaxillary region, several being as large as a peanut. There are one or two also in right supra-clavicular region, also four in left side of neck posterior to the angle of the jaw along the anterior border of sterno-mastoid. No sign of acute inflammation, suppuration, or adherence to skin. No mention of axillary involvement.

Operation, by Dr. McCosh, April 24.—An enlarged gland removed, anterior and posterior to the right sterno-mastoid; small gauze drain in lower angle.

Pathological Report.—Lymph-nodes a little enlarged, containing cheesy spots.

Case VI.—M. K., aged fifteen; New York; school-boy.

History.—Patient was admitted to hospital November 5, 1894; discharged November 26, 1894; service of Dr. Briddon. No family tuberculous history; mother died of pneumonia. Three months ago patient noticed a swelling under the left arm the size of a small hen's egg, and since then the tumor has been gradually increasing in size. No pain except on pressure. Has had dry cough for several weeks.

Physical Examination.—There is a movable lobulated mass in left axilla, size of a small orange. Skin not adherent and normal; some tenderness on pressure. Lungs: Slight dulness in left apex; now and then a few subcrepitant râles over both lungs. No enlargement of cervical glands.

Operation by Dr. Briddon.—Incision five inches in length along the lower margin of the pectoralis major, exposing the axilla. Tumor was removed, and an opening was made additionally in the lower part of the axilla for drainage.

Pathological Report by Dr. Thacher.—Microscopical examination: The characteristic appearance of tuberculous inflammation in the axillary gland.

Subsequent History.—Patient returned to the hospital November 13, 1899; discharged November 29, 1899. For the past year the patient has noticed swelling on left side of the neck, but the mass has been somewhat smaller during the last few months. No severe pain; no sinus formation. Has a slight cough; no night-sweats; general health good.

Physical examination showed the left cervical glands, anterior and posterior to the sterno-mastoid, to be enlarged, hard, but not broken

down, and they extend down below clavicle. There is an old scar in the left axilla.

Operation by Dr. Briddon.—Extensive dissection down to vessels from the mastoid process to and below the clavicle. The sterno-mastoid was divided (later united) and a large mass of glands removed, two being below the clavicle.

Pathological Report (Dr. Thacher).—Showed several cheesy glands; microscopical examination showed tuberculous inflammation.

Patient returned again to the Presbyterian Hospital in December, 1900. Several small glands are present on the left side of the neck, where there are a few sinuses discharging pus. Several suppurating glands were removed from the left side of the neck. Three months later patient again returned to the hospital, showing numerous enlargements in right and left cervical regions, more on the left side. Several abscesses were opened by Dr. Eliot, sponged dry, and sewed up.

The *Pathological Report* by Dr. Tuttle showed tuberculous inflammation.

Case VII.—A. R., aged fifteen; school-girl; United States.

History.—Patient was admitted to hospital April 8; discharged June 9, 1899; service of Dr. Briddon. She had the ordinary childhood diseases; never a cough or night-sweats. Eight months ago patient became aware of a swelling in the left cervical region which was unaccompanied by pain. Two months later there was an enlargement in the right cervical region, and a few weeks after a few small glands could be felt in the left axilla. Patient feels perfectly well.

Physical Examination.—Lungs normal. There are enlarged lymph-nodes on both sides of the neck. In the left axilla is a small mass, evidently glands.

Operation, by Dr. Briddon.—In the left cervical region an incision was made from the mastoid process to the clavicle, down to the vessels, and several large lymphatic nodes were removed. Two drains of rubber tissue.

Pathological Report by Dr. Tuttle.—Microscopical examination: Tubercular inflammation with much cheesy degeneration.

Subsequent History.—About one month later another operation was performed in the right cervical region and a large chain of glands removed. Several enlarged lymph-nodes were dissected from the left

axilla. Small gauze drain in one angle of wound. There was no pathological report on these glands.

Case VIII.—A. P., aged fifty-six; married; carpenter; German.

History.—Patient was admitted to hospital February 18; discharged March 9, 1900; service of Dr. McCosh. No family tuberculous history. He has had a cough with considerable expectoration, blood-stained at times, for about two months. Eight months ago a painful swelling appeared over the sternum and itwa s opened two months later, with considerable discharge of pus. The bone was thoroughly curetted, and since that time has had quite a number of minor operations performed, with removal of several pieces of necrosed bone. A sinus has persisted ever since the first operation. Soon after the first process formed several swellings appeared in the left axilla and in the neck, and these were soon opened but have not healed. He has lost considerable flesh and strength and has been unable to work during the past six months.

Physical Examination.—There is dulness in the left supraclavicular and upper left three spaces, with numerous scattered subcrepitant râles all over both chests. There is a sinus about one inch deep surrounded by a mass of glands, the mass apparently extending up toward the apex of the axilla. Three other sinuses exist: one low down in the right cervical region, with an enlarged gland just outside of it; one over the middle of the sternum, opposite the second costal cartilage, one and a half inches deep, running down to the bare bone; a third on the left side of the neck half an inch deep.

Operation by Dr. Eliot. — An incision was made three inches long down to the left sterno-clavicular articulation, and considerable necrosed bone was removed and the joint curetted. Another incision four inches long was made in the left axilla, and a mass of enlarged, broken-down lymph-nodes and considerable granulation tissue were found and both removed. The glands extended deep and high up in the axilla along the vessels. A counter opening was made posteriorly for drainage. Iodoform gauze drain in both incisions.

Pathological Report by Dr. Thacher.—Mass from axilla contained some large lymph-nodes with numerous small yellow spots, some of them liquefied. Microscopical examination: Tuberculous inflammation.

Subsequent History. — He returned to the hospital October 4,

and was discharged October 19, 1900. Several smaller swellings have appeared lately, one above and one below the left clavicle, and one on the right side of the neck. General health is the same, but he has a chronic cough, with much expectoration.

On *physical examination*, the lungs were unchanged, and just below and above the left clavicle was a fluctuating tender swelling. In addition there were three sinuses, one leading into the left axilla. The sinuses were curetted, and fluctuating swellings opened, with discharge of pus. Iodoform drain.

Case IX.—L. W., aged twenty-six; single; housemaid; England.

History.—Patient was admitted to hospital February 26, discharged March 26, 1900; service of Dr. Briddon. An uncle and aunt, on the mother's side, died of tuberculosis. Three years ago she noticed a small mass in the left axilla, which at times became very painful and tender. It was poulticed, and finally there was spontaneous evacuation of pus, the wound subsequently healing. The mass has reappeared since then about five times, with the same subsequent history. One year ago she noticed a small, firm swelling, the size of a hazel-nut, in the left cervical region. The mass has gradually increased in size up to one month ago; since then its growth has been more rapid and she has had considerable pain.

Physical Examination.—There is a mass the size of a hen's egg along the anterior border of the left sterno-mastoid; it is lobulated, skin is movable over it, and the mass is movable upon deeper parts. No softening. In the left axilla is a swelling the size of an English walnut, and below the axilla are three scars. The inguinal glands are palpable, but not much enlarged.

Operation by Dr. Briddon.—Incision three inches long was made along the anterior border of the left sterno-mastoid with removal of several large lymph-nodes, some being broken down and pus escaping. A second incision was made behind the sterno-mastoid and a few glands removed. A third incision was made in the left axilla, and a large mass of glands was carefully dissected from the axillary vessels. All wounds partially closed and iodoform drainage employed.

Pathological Report (Dr. Thacher).—Numerous glands with cheesy foci. Microscopical examination: Tuberculous inflammation.

Subsequent History.—Patient returned again October 29, and was

discharged November 10, 1902. One year after operation there was recurrence noticed in the left axilla, and on the same side of the neck, but unaccompanied by pain. Swellings have changed little since that time, but she has gradually grown thinner, and has had occasional night-sweats.

Physical examination showed the pharynx to be congested. There are three enlarged lymph-nodes in the left cervical region and a small chain in the right, both anterior to the sterno-mastoid. In the left axilla is a group of glands, all of which are firm, and a few small glands in the right axilla, and in both groins. The lungs show subcrepitant râles between the clavicle and the fourth rib on the left side.

An operation was done, numerous enlarged lymph-nodes being excised from the left side of the neck, and four or five from each axilla.

The *Pathological Report* by Dr. Thacher showed numerous small cheesy lymph-nodes. Microscopical examination: Tuberculous inflammation.

On discharge from the hospital the axillary wounds were closed, but the cervical still presented a small sinus.

The patient returned again to the hospital January 19; discharged January 26, 1903. She now has considerable cough, with blood-stained sputum. Patient is poorly nourished, and there are many enlarged glands on the left side of the neck, especially high up. All are firm and distinct. Lungs are negative. Several incisions were made on left side of neck. No mention made of the axilla.

Case X.—A. F., aged twenty-eight; single; supervisor; German.

History.—Patient was admitted May 21; discharged June 7, 1901; service of Dr. McCosh. No family history of tuberculosis; denies venereal disease. Fourteen days before he had suffered a blow on the left index finger with a hammer. Six days later there were several chills, accompanied by fever, and he was confined in bed three days. Two days later he noticed a painful lump in the left axilla, the swelling gradually increasing and growing constantly more tender.

Physical Examination.—A few glands were palpable in right axilla and in both inguinal regions. In the left axilla is a rounded, firm, tender mass the size of a walnut. Skin slightly reddened over it—hot; mass movable on the chest. Over the posterior aspect of the left index finger, about the second phalanx, is a small recent scar. The

following day the mass was still larger, and a sense of deep fluctuation was obtained. Lungs are negative. On admission, temperature was 102°; normal three days after operation; pulse never above 80.

Operation, May 23, by Dr. McCosh.—Incision drainage, several ounces of pus being evacuated. The remains of a superficial gland the size of an egg were scooped out and cavity packed with iodoform gauze. Wound healed rapidly. Leucocytes were 8,000; hæmoglobin, eighty per cent. at time of operation.

Pathological Report by Dr. Thacher.—Gland microscopical examination: Tuberculous inflammation.

Case XI.—M. O., aged thirty; single; marble polisher; United States.

History.—Patient was admitted June 10; discharged June 22, 1902; service of Dr. Eliot. Family history negative to tuberculosis; he has had scarlet fever, but never diphtheria. Three years ago patient felt a pain in the region of the right shoulder, pain being dull and aching in character, and increased by using the arm. He noted a swelling at this time in the right axilla. Subsequently the pain became so severe that he was compelled to give up work. The tumor was excised by his physician and the patient was apparently cured. Four weeks ago he began again with pain, dull and aching in character, in the right axilla, and on examination noticed a mass the size of a peach, which was hard and circumscribed. The tumor has not increased in size since then. He stopped work and the pain was considerably diminished, but his physician has advised him to have the tumor removed. His chief complaint is stiffness and soreness in the right arm when attempting to work.

Physical Examination.—Patient is not anæmic; lungs negative. In the right axilla is a scar three inches in length, and beneath the skin are three enlarged glands about the size of hazel-nuts.

Operation by Dr. Eliot.—Incision two inches in length along the lower margin of pectoralis major. Three small glands removed; one up under the pectoralis major.

Pathological Report by Dr. Tuttle.—Microscopical examination: Tuberculous inflammation. Cheesy areas, lymphocytes; a few giant-cells. No evidence of new growth.

Case XII.—R. F., aged eighteen; single; clerk; United States.

History.—No family history of tuberculosis; has never had any prolonged cough, and general health has always been good until present illness. Early in May, 1902, he began to complain of pain in the right axilla and shortly after noticed a mass in this region. Pain continued and the mass increased. In June, 1902, an abscess in the right axilla was opened by another physician. The wound was dressed at frequent intervals, and a discharging sinus still remained when he first came under observation, late in June, at which time his general health was slightly impaired.

Physical Examination.—Patient is slightly anæmic; lungs are negative. There is a sinus two inches long in the right axilla, discharging thin, watery pus. This leads inward to a mass which is slightly tender, somewhat adherent to the skin, but freely movable on deeper parts. No other superficial glands enlarged.

Operation, by Dr. Lee, July, 1902.—Vertical incision, four inches long, was made through centre of the base of axilla. Skin-flaps were dissected back, exposing the axilla and the lower border of the pectoralis major muscle. The sinus was isolated and removed, together with a large mass of glands, the latter extending up along the axillary vessels for a considerable distance, ready access being allowed by strong retraction of the pectoralis major muscle. Two additional isolated glands were removed from beneath the under surface of this muscle. This left a large cavity, which was partially closed in by drawing down the lower border of the large pectoralis muscle and suturing it with chromicized catgut to the latissimus dorsi. Wound closed, except for small drain of sterile gauze covered with rubber tissue.

Pathological Report.—A large mass of lymph-nodes containing numerous small abscesses. Microscopical examination: Tuberculous inflammation.

Subsequent History.—Wound healed completely at three months. At present date patient is in excellent health and there has been no recurrence in the axilla. No enlargement of any other superficial glands.

Case XIII.—J. W., aged forty-nine; married; clerk; United States.

History.—No family tuberculous history; he has always been healthy. In February, 1902, patient began with pleurisy with effusion on the left side. Fluid was aspirated, but patient did not return to

work for several months. In September, 1902, the left ring-finger became infected from a small sliver of rope; this infection soon subsided, but a swelling shortly appeared in the left axilla. An attempt was made to favor resolution by local applications of ichthyol ointment, without success. The swelling was opened about two months after its inception and considerable thick, yellowish pus evacuated, and the abscess was drained. There was never any pain in the swelling, but his left arm has felt weak, and his general health is somewhat impaired.

Physical Examination.—Patient rather anæmic; lungs are negative except for some dulness; diminished breathing and old pleuritic friction sounds over the lower part of the left chest posteriorly. In the left axilla is a sinus three inches long, discharging pus, and beneath it is a large tumor, somewhat tender, freely movable, but adherent to the skin.

Operation by Dr. Lee, January 6, 1903.—A vertical incision three and one-half inches long was made over the centre of the mass, which was dissected out, together with the sinus tract. During the excision of the glands several small abscesses were opened into, soiling the wound, which was irrigated with salt solution. The pectoralis major muscle was drawn back during the operation to afford better exposure. Wound closed; small drain of sterile gauze.

Pathological Report.—Large mass of glands; some cheesy degeneration. Microscopical examination: Tuberculous inflammation.

Subsequent History.—Physical examination made December 23, 1903, showed lungs to be normal, and patient's general health good. There had been no recurrence in the left axilla, and no enlargement of cervical glands could be made out.

DIAGNOSIS.

The differentiation in tuberculous axillary adenitis must be made from a simple hypertrophy of axillary glands, due to sweat irritation, a simple abscess from infection and from various new growths, benign and malignant, including axillary enlargement in Hodgkin's disease. The history is at times very misleading, as in Cases X and XIII, when the axillary adenitis followed an infection of the finger. Gulland says that where inflammation in a gland following infection does not soon

subside when the infection is removed, suspect the entrance of tubercle. A family history of tuberculosis is often lacking—in this series being obtained but twice, and then with no infection in any member of the immediate family. In all save four the general health was impaired, more or less, at the time of first observation; three of these were uncomplicated by cervical disease, and the history extended over a short period, varying from two weeks to three months. Pain, most authorities agree, is unusual in tuberculosis of glands. Holt, in discussing tuberculous adenitis in children, points out that usually the enlargement of the glands is slow, adherence to surrounding structures appears in time, caseation and suppuration must be expected in cases of any standing, and response to constitutional treatment is often disappointing. The presence of associated tuberculous lesions (in other glands, in the lungs, or in bones or joints) makes more probable a diagnosis of tubercular disease of the axillary lymphatic nodes. Osler, Northrup, Otis, and Mitchell advise the use of tuberculin as a means of diagnosis, stating it to be of real value in doubtful cases, and devoid of danger. Osler, however, calls attention to the fact that when Hodgkin's disease has existed for some time, a reaction with tuberculin may be obtained.

TREATMENT.

Constitutional.—A suitable climate is an essential feature of the general treatment, and where practicable, should always be tried, before resorting to surgery, except in those cases with well-marked lesions. Osler urges the importance of taking good care of the digestive organs of persons afflicted with glandular tuberculosis. Cod-liver oil, iron, strychnine, arsenic, and potassium iodide have all been advised, and are of importance about in the order named. The author believes, however, that as much, if not more, stress should be placed upon general treatment after operation as well as before, and that perhaps not sufficient care is usually exercised in advising patients recently operated upon for tuberculosis of glands concerning general medicinal and climatic measures.

Surgical.—(*a*) Conservative: The use of iodoform emulsions, in ether or glycerine, is of doubtful efficacy, for, as Freeman states, the glands are seldom reached. In Cases XII and XIII the infection

of lymph-nodes was so extensive that emulsions could only have reached the superficial surface of the nearest glands. They may be employed, though, in those individuals where sinuses and small abscesses are so numerous as to make a thorough dissection impossible. Local applications of ichthyol ointment may be tried in early cases, and occasionally seem of benefit. Pulmonary tuberculosis is no contra-indication to operation, except where the disease of the lungs is far advanced, and most surgeons agree that a tuberculous focus in a lymphatic gland is a constant source of danger to the individual. Syms and Harnet make a plea for conservatism in surgery, believing a radical operation unnecessary in the vast majority of cases. Of late, treatment by the X-ray has been tried, and some have reported moderate success with this method. Dr. McCosh, in 1902, made use of it, in an example of tuberculous cervical adenitis, with some diminution in the size of the gland, but without a positive cure. It would seem to be of even less efficacy in the axilla, because of the added inaccessibility of the glands. (*b*) Radical: When surgical procedure is employed, many emphasize the advisability of a clean dissection rather than operating with a spoon, because of the lessened danger of systemic infection. Gulland advises the most radical measures in operating upon tuberculous glands of the neck, stating that not a single affected or possibly affected lymph-node should be left, and the same is true of the axilla, when involved alone or secondary to cervical adenitis.

The scar in the axilla is of little importance from a cosmetic standpoint, and the incision should, therefore, be sufficiently liberal to allow ready access to the entire axilla, providing the case is at all advanced. The direction of the incision in two instances was vertical; in two others, along the lower border of the pectoralis major muscle; in another, obliquely across the base of the axilla. The incision first mentioned will give, in the vast majority of cases, the best exposure of the entire axilla, but the special incision to be employed must be determined in each individual case, depending upon the site of the enlarged nodes. If the disease is extensive, a partial division of the pectoralis major may be necessary, as was done in Case V, but a strong retraction of the lower border of this muscle will usually give a good exposure. The glands situated behind the minor, along the inner side of the axillary vein, may be reached by drawing aside the muscle. Drainage of the wound

is advised in cases where a soiling of the wound with purulent discharge cannot be avoided. Iodoform gauze is the material usually employed for drainage; whether it has any special action in tuberculous diseases is doubtful.

RECURRENCE.

Two cases recurred in the axilla, one having originally an extensive cervical adenitis, the other being a fairly advanced example of tuberculosis, with several sinuses, one extending into the axilla, where a complete operation was impossible. In the remaining eleven cases there had been no return of the disease in the axilla, as far as it has been possible to follow the patients. This would argue for radical measures here where hope of a permanent cure is great, for recurrence would seem much less frequent than in the treatment of tuberculous cervical adenitis.

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XIII.

BLOOD FINDINGS IN A SERIES OF SKIN DISEASES.

By John W. Coe, M.D.

Numerous observers have reported changes in the condition of the blood as the result of some lesion of the skin, but so far as we know there have been no reports of cases which have been followed for so long a time as have some in this series.

We shall first give in tabulated form a brief report of examinations:

Herpes Zoster.

No.	Name.	Age.	Sex.	Location.	Duration.	Date.	Polynuclear.	Small Mononuclear.	Large Mononuclear.	Eosinophile.	Mast Cell.	Remarks.
1	E.M.	24	F.	Left thigh and leg	7 days	June 3, 1903	83.0	12.3	4.7	0	0	Temp. 101°; malaise; slight leucocytosis.
						June 5	57.3	26.0	12.9	2.7	0.9	Much improved; Temp. 99.2°.
						June 8	70.3	20.0	5.6	3.0	1.0	Temp. 98°; well.
2	A.N.	17	F.	Right arm and hand	4 days	Oct. 29, 1902	75.6	13.6	10.3	0.3	0	Smear from vesicle; few cells, mostly polynuclear.
3	P.Q.	42	M.	Right axilla	7 days	Apl. 28, 1902	32.2	29.7	35.7	1.3	0.7	
4	S.K.	18	F.	Right chest	10 days	July 23, 1902	64.8	20.9	11.4	2.0	0.7	
5	S.K.	33	F.	Left chest	7 days	Mch. 13, 1903	67.3	19.4	10.3	1.3	1.3	Few leucocytes.
6	A.B.	11	F.	Left chest and arm	3 days	Apl. 6, 1903	73.5	16.3	9.7	0.5	0	
7	W.K.	11	M.	Lumbar region	2 days	Oct. 27, 1902	66.0	19.6	11.0	3.3	0	Few leucocytes.
8	F.K.	21	F.	Face		May 14, 1903	83.0	11.7	5.0	0	0	
9	K.K.	15	F.	Lumbar region		July 23, 1902	65.0	23.1	8.4	2.9	0.4	
10	D.B.	19	M.	Face	Several days	May 18, 1902						No malarial parasites.
11	E.G.		F.	Right axilla	4 days	Oct. 17, 1902						No malarial parasites.

ECZEMA.

No.	Name.	Age.	Sex.	Location.	Duration.	Date.	Polynuclear.	Small Mononuclear.	Large Mononuclear.	Eosinophile.	Mast Cell.	Remarks.
1	O.E.	4	M.	General		Apl. 14, 1902	53.7	28.4	4.7	13.0	0.2	
						Apl. 16	57.7	26.3	7.4	8.0	0.5	
2	R.C.	32	F.	Chest and back	4 days	May 14, 1902	72.9	16.1	7.8	1.8	1.1	
3	K.N.	46	F.	Neck and legs	2 yrs.	May 26, 1902	42.3	35.5	18.8	1.9	1.2	
4	M.D.	37	F.	Arms and legs	5 yrs.	June 6, 1902	74.8	13.7	9.2	1.5	0.6	
5	J.G.	1½	M.	Face and arms	12 mos.	Jan. 12, 1903	43.8	38.8	9.6	6.9	0.8	
6	A.M.	36	M.	General	2 mos.	Jan. 16, 1903	62.5	18.1	4.6	13.8	0.9	From scabies
						Feb. 6	69.2	15.6	7.8	6.6	0.8	Nearly well.
						Mch. 13	56.1	28.5	10.1	4.8	0.4	Entirely cured.
7	H.J.	27	F.	Hand	Few days	Apl. 27, 1903	72.7	18.0	8.7	0.2	0.2	Recurring, 16 yrs.
8	M.E.	10	F.	General	2 mos.	Mch. 2, 1903	68.5	22.5	5.2	3.8	0	
						Mch. 13	59.0	21.3	6.3	13.3	0	
						May 18	73.7	18.7	5.6	1.7	0.3	One week after crisis of lobar pneumonia.
						June 8	55.8	22.0	4.8	17.4	0	
						July 6	53.6	21.7	8.0	16.7	0	
						July 24	58.0	21.0	5.6	15.4	0	Improving.
						Aug. 28	68.7	18.8	3.8	8.6	0	Marked improvement; condition excellent.

PSORIASIS.

1	A.C.	7	F.	General	4 mos.	Sept. 22, 1902	46.4	23.4	8.1	21.9	0	Apparently no leucocytosis.
						Sept. 24	59.0	18.7	5.2	16.5	0.3	
						Sept. 26	61.6	15.3	4.0	18.3	0.6	Leucocytes 19,000
						Oct. 1	59.2	20.4	4.8	15.2	0.4	
						Oct. 8	78.8	12.0	6.0	2.8	0.4	
						Oct. 15	69.4	19.7	6.8	3.7	0.2	
						Oct. 29	71.0	16.0	8.5	4.5	0	Much improved.
						Nov. 7	69.1	15.5	6.1	8.5	0.6	
						Nov. 17	74.0	12.0	9.0	5.0	0	Entirely cured.
						Sept. 7, 1903	49.0	23.2	8.7	18.6	0.4	Well since last seen excepting for small patch on left leg.
2	E.A.	49	F.	General	1 yr.	Feb. 4, 1903	53.8	33.8	8.4	2.7	1.1	
						Apl. 10	48.3	31.3	12.2	7.3	0.8	
3	A.F.	28	F.	Elbows and knees	2 mos.	May 7, 1902	66.4	24.6	8.0	0.9	0	Recurring 16 yrs.

DERMATITIS HERPETIFORMIS

No.	Name.	Age.	Sex.	Location.	Duration.	Date.	Polynuclear	Small Mononuclear	Large Mononuclear	Eosinophile.	Mast Cell.	Remarks.
1	C.S.	3	F.	Trunk and legs	2 wks.	June 6, 1902	58.8	16.7	7.8	16.5	0	Leucocytosis; Temp. 99.6°.
						June 9	57.3	22.4	7.2	12.8	0.2	R.b.c., 4,504,000; w.b.c., 32,000; hb. 85%.
						June 14	65.2	17.1	7.6	10.0	0.1	Smear from fresh vesicle; few cells, mostly polynuclear, some mononuclear.
						June 20	52.0	16.6	11.0	20.0	0.3	Several fresh eruptions
						June 30	52.9	19.8	8.8	18.0	0.3	
						July 7	52.0	23.2	5.3	18.9	0.5	
						Sept. 15	63.9	20.6	2.8	12.5	0	High leucocytosis; child losing flesh; one normoblast found.
						Oct. 21	48.0	28.0	10.2	13.7	0	Condition excellent; no eruption for 3 weeks.
						Sept. 1, 1903						Condition excellent: no eruption for 10 months.

PEMPHIGUS.

1	M.K.	44	F.	General	4 mos.	Dec. 10, 1900	27.3	12.8	7.8	51.8	0	R.b.c., 4,300,000;
						Dec. 30	30.9	15.2	4.9	49.0	0	w.b.c., 12,000; hb., 77.
						Mch. 11, 1901	71.5	13.3	4.5	10.5	0	Fresh crop on March 10.
						Apl. 7	43.8	4.3	1.1	50.7	0	Improvement rapid and steady after this date.
2	J.H.	68	M	General	6 mos.	June 12, 1902	91.6	6.0	2.0	0.2	0	Specimen taken 3 hrs. before death.

URTICARIA.

1	L.M.	21	F.	Arms and legs	Few days	May 5, 1902	68.5	23.4	6.9	0.9	0.2	
2	A.G.	3	F.	Arms and face	1 yr.	Apl. 21 1902	52.1	37.0	8.8	2.0	0	
3	J.M.	17	M.	General	1 day	Apl. 28, 1902	92.8	3.8	3.4	0	0	Marked leucocytosis; numerous malarial organisms; double tertian.
4	N.E.	14	F.	Arms and legs	2 wks.	May 23, 1902	78.8	13.8	6.7	0.5	0	
						Sept. 24	75.0	15.3	9.3	0.3	0	
5	A.B.	3	F.	General	1 yr.	July 6, 1903	44.2	42.2	10.0	3.5	0	
6	M.D	1½	M	General	15 mos.	Oct. 24 1902	20.0	52.3	13.3	4.0	1.3	

ERYTHEMA OF ACRODYNIA TYPE.

No.	Name.	Age.	Sex.	Location.	Duration.	Date.	Polynuclear.	Small Mononuclear.	Large Mononuclear.	Eosinophile.	Mast Cell.	Remarks.
1	J.D.	34	M.	Palms, soles, mouth	7 days	May 25, 1903	78.2	13.7	7.1	0.9	0	Similar attack one year ago.
						June 1	77.0	17.0	5.7	0.3	0	No leucocytosis.

DERMATITIS MEDICAMENTOSA.

1	F.N.	28	M.	Leg and arm	2 days	June 8, 1903	88.4	8.6	2.8	0.2	0	Some leucocytosis.
						June 10	88.8	9.0	1.8	0.4	0	W.b.c, 22,600; temp. 101.3°.

ERYTHEMA NODOSUM.

1	N.M.	22	F.	Both legs	2 wks.	Apl. 21, 1902	81.9	9.7	4.4	3.6	0.2	
2	H.R.	2	F.	Both legs	5 days	May 27, 1903	68.0	25.0	7.0			Temp. 104°.
3	M.D.	9	F.	Legs	Few days		57.5	24.2	13.6	3.7	0.8	
4	Child			Legs			78.4	12.2	6.8	2.4	0	

ERYTHEMA INDURATUM.

1	M.K.	16	F.	Both legs	3 wks.	July 13, 1903	65.4	24.6	5.3	4.6	0	No leucocytosis.

ERYTHEMA MULTIFORME.

1	B.H.	17	F.	Both hands	1 wk.	June 25, 1902	70.5	19.4	7.5	1.8	0.7	
2	J.S.	18	F.	Hands and face	2 wks.	May 1, 1903	73.3	19.0	7.0	0.6	0	Recurring.

HERPES IRIS.

1	B.K.	23	F.	Left wrist	7 days	June 6, 1902	73.2	16.2	9.0	0.9	0.4	

ANGIO-NEUROTIC ŒDEMA.

1	J.H	23	M.	Legs		May 14, 1903	85.4	9.8	4.4	0.2	0.2	Moderate leucocytosis.

ACUTE EXFOLIATIVE DERMATITIS.

No.	Name.	Age.	Sex.	Location.	Duration.	Date.	Polynuclear.	Small Mononuclear.	Large Mononuclear.	Eosinophile.	Mast Cell.	Remarks.
1	B.T.	57	M.	Arms, hands, thighs	1 wk.	May 9, 1902	74.6	16.8	6.1	1.0	1.2	Recurring
						May 19	63.6	21.7	10.0	3.0	0.8	
						May 23	82.2	10.1	5.6	1.4	0.4	
						May 26	76.1	10.9	7.6	4.1	1.0	
						June 6	71.3	17.7	7.1	3.1	0.6	
2	J.K.	58	M.	Arms and legs	10 wks.	Jan. 21, 1903	60.0	23.2	7.4	8.8	0.6	
						Jan. 28	60.7	32.0	4.5	2.7	0	

LICHEN PLANUS.

1	L.L.		F.			July 11, 1902	61.2	23.7	9.6	4.8	0.4	

ICHTHYOSIS.

1	H.H.	3	M.	General	Life	Oct. 29, 1902	43.8	35.6	17.4	3.2	0	
2	C.D.	6	F.	Legs	Life	Mch. 16, 1903	51.6	36.6	9.2	2.2	0.2	
						Mch. 27	63.2	24.2	6.6	5.5	0.2	slight eczema.
3		30	M.	General	Life		60.3	23.7	14.6	1.2	0	

PRURIGO.

1	D.S.	23	M.	General	23 yrs.	Apl. 25, 1902	61.4	22.9	5.8	9.5	0.1	
						Apl. 28	70.7	17.1	7.0	5.0	0	
						May 5	72.4	13.4	9.8	3.0	0.3	
2	J.L.	12	M.	General	3 yrs.	Sept. 12, 1902	54.8	23.7	7.3	14.1	0	No leucocytosis.

Winfield[1] reported, in 1895, eight cases of herpes zoster, in four of which malarial organisms were found, and expressed the opinion that malaria belongs in the front rank as causing zoster.

Again,[2] in 1902, he reported twenty-five cases, fourteen of which—that is, fifty-six per cent.—showed malarial parasites, while all the patients gave evidence of some infection. A few other observers have reported the presence of malarial parasites in the blood of patients with herpes zoster, but so far as we know, none has found so high a percentage.

Engman [3] reports eighteen cases of various eruptions associated with malarial infection, five of which were herpes zoster. Other changes have been noted in the blood of zoster patients. Thus Leredde [4] found a marked decrease of white blood-cells, and after the disease had progressed a week or more, an increase of the eosinophilic leucocytes to six or eight per cent.

Sabrazes and Mathis [5] reported seven cases of zoster with blood examination. Their conclusions were that a leucocytosis develops as early as the first day of the eruption, and increases to the third day; after which it gradually diminishes, reaching normal by the fifth day. One of their cases showed an eosinophilia of $20\frac{5}{10}$ per cent., while in the remaining cases these cells varied between $\frac{3}{10}$ and eight per cent.

Bettman [6] holds that while the vesicles of herpes zoster may contain a high proportion of the eosinophilic cells, the blood usually shows no increase.

Zappert [7] gives a list of thirty-eight blood examinations in skin diseases, two of which were zoster cases. These two showed a leucocyte count of 4,200 and 5,920, the eosinophilic cells being only $2\frac{6}{10}$ per cent. and $2\frac{7}{10}$ per cent.

In the eleven cases of herpes zoster tabulated above, a thorough search was made for malarial parasites, but none were found. Most of the patients gave evidence of some constitutional disturbance, but all recovered without malarial treatment.

A differential count of the leucocytes was made in nine of the cases, $3\frac{3}{10}$ per cent. being the highest eosinophilia noted.

There seems to be nothing characteristic in the blood of patients with herpes zoster.

There are tabulated above ninety-two blood-examinations of fifty different cases and seventeen different diseases. In all, a careful search was made for malarial parasites, with a negative result in all but one instance, a case of general urticaria, in which there was a double tertian infection. In this patient the urticarial eruption certainly preceded the onset of malarial symptoms, and was not due to any medication. This condition has frequently been reported in malaria, and is probably the most common cutaneous lesion encountered. Of the eighteen cases reported by Engman [8] in which malarial parasites were found, six were urticaria, five herpes zoster, three pompholyx, two erythema

multiforme, one multiple spontaneous gangrene, and one an anomalous eruption.

The most common change observed in the blood of patients with skin diseases is an increase in the eosinophilic leucocytes. The normal percentage of these cells is given by various investigators as from one to seven per cent.

Canon [9] reports a series of twenty chronic skin diseases, in thirteen of which a comparatively small part of the cutaneous surface was involved, the remaining seven having very extensive involvement. Ten of the mild cases were psoriasis, two prurigo, one a syphilitic exanthem, and in these the eosinophilic cells averaged $3\frac{7}{10}$ per cent. In the list of severe cases there were two with eczema, the highest eosinophilic count being $14\frac{9}{10}$ per cent., one with prurigo having $11\frac{2}{10}$ per cent., three with psoriasis, the highest eosinophilia being seventeen per cent., and one with Addison's disease, having $8\frac{7}{10}$ per cent.

From his investigations, Canon concludes that it is less the variety of the skin lesion, or its local intensity, than the extent of the disease process that exerts an influence on the degree of the eosinophilia.

Following Canon, Zappert [10] reported a list of thirty-eight cases of various skin diseases. His conclusions were that a large number of skin affections often show a marked increase in the eosinophilic cells, and this seems to depend upon the variety and intensity of the lesion, its extent being a secondary consideration. He also holds that with a high eosinophilia there is slight tendency to heal. Some of his examinations were: pemphigus showing thirty-three per cent. of eosinophilic cells; eczema, $9\frac{7}{10}$ per cent.; psoriasis, $9\frac{8}{10}$ per cent.; sclerodermia, $9\frac{4}{10}$ per cent.; lupus, $12\frac{2}{10}$ per cent.; erythema multiforme, $4\frac{7}{10}$ per cent.

There have been numerous reports by other observers of various degrees of eosinophilia. Thus Cabot [11] records a case of dermatitis herpetiformis having nineteen per cent. of eosinophilic cells; Brown [12] one with forty-four per cent. in the same condition; T. R. Brown,[13] one with twenty-four per cent. from chronic eczema; and a case of epidermolysis bullosa showing $9\frac{7}{10}$ per cent. Lazarus reports a case of urticaria in which the eosinophilic cells were sixty per cent.

Referring to our table, it will be seen that the highest eosinophilic count noted was $51\frac{8}{10}$ per cent. in a case of pemphigus with recovery. Next in order is a case of psoriasis with $21\frac{7}{10}$ per cent., followed by a

case of dermatitis herpetiformis with twenty per cent.; generalized eczema with $17\frac{4}{10}$ per cent.; prurigo with $14\frac{1}{10}$ per cent.; eczema with $13\frac{8}{10}$ per cent.; eczema with thirteen per cent., etc.

Excluding the case of pemphigus which has been previously reported,[14] let us consider the patient with psoriasis showing twenty-one per cent. of eosinophilic cells. When coming under observation the eruption had existed for four months. There was a generalized eruption over the entire body and scalp. The leucocyte count was 10,000. The child came to the dispensary regularly, and steadily improved, so that by the end of two months she was discharged as cured. The eosinophilic cells in the meantime fell to five per cent., and this decrease followed in a few days the beginning of treatment. Nearly ten months after having been discharged the patient was seen at her home. The parents reported that the child had been well with the exception of a small patch on the left leg. The patient was apparently in perfect health, the only evidence of any disease being a small scaly patch the size of a dime on the left leg. Blood-examination on this date showed the eosinophilic leucocytes to be $18\frac{6}{10}$ per cent. Whether this presages another outbreak or not, we are at present unable to say. This case seems to support Canon's theory that an extensive involvement gives a high eosinophilia, and to disprove Zappert's idea that with an eosinophilia there is slight tendency to heal. What significance there may be in the return of the eosinophilia ten months after recovery, we cannot say.

The case of dermatitis herpetiformis was under treatment for nearly five months. There was for several weeks of this period slight fever and evidence of a marked infection. During the first four months successive crops of the eruption appeared, and the eosinophilia varied irregularly between ten and twenty per cent. During the last month of the treatment the improvement was rapid, and for three weeks before being discharged there was no sign of any further trouble. Yet on this last date the eosinophilic cells were $13\frac{7}{10}$ per cent. Over ten months later this child was again seen, and was in perfect health. No blood-examination was permitted. The skin involvement in this case was much less than in the child with psoriasis, yet the degree of the eosinophilia was the same, and the improvement, while less rapid was marked.

The patient with general eczema showing an eosinophilia of $17\frac{4}{10}$ per cent. has now been under treatment for seven months, and the disease dates from two months before that time. This case is very resistant to treatment, yet there is a decided improvement, very slow, but steady. The eosinophilic leucocytes at the time of the last examination were $8\frac{6}{10}$ per cent., after having been between five and twenty per cent. for three months. In connection with this case it is of interest to note that while under observation the child developed an acute lobar pneumonia. The eczema rapidly disappeared, and before the crisis was reached the patient's skin was as soft and clean as possible. The eosinophilic leucocytes in the meantime dropped to $1\frac{7}{10}$ per cent. Shortly after the crisis the ezcema began to return, and with this the acid-staining leucocytes of the blood again became much increased.

The case of generalized eczema in a man aged thirty-six was of scabietic origin. The history of this case dated back two months, and the eosinophilic leucocytes were $13\frac{8}{10}$ per cent. at the beginning of treatment. The improvement was rapid, and coincident with this the eosinophilic leucocytes rapidly fell.

We shall not discuss the remainder of the cases in which the eosinophilic leucocytes were increased, since they could not be followed in detail.

From the examination of the table and the discussion of the few cases above, it will be seen that all of the cases in which there was a marked eosinophilia were with a large surface involvement.

The question would now naturally arise, Do all such cases give an increase in these cells? From the study of the table we see that such a general rule cannot be made.

All of the cases of eczema with general involvement show a decided increase in the eosinophilic cells, while the highest count noted with a localized process was $6\frac{9}{10}$ per cent. The disease in this case was of twelve months' duration, involving the head and arms. The second patient with psoriasis was a woman aged forty-nine, with an eruption of one year's duration covering the entire body and scalp. This patient remained under treatment for two and a half months, with slight improvement, during which time the highest eosinophile count was $7\frac{3}{10}$ per cent. Only two counts are recorded, but several incomplete examinations were made, and found negative.

Of the cases with urticaria, all were extensive, while three of the number were general. No eosinophilia was observed in any of these.

In both of the patients with acute exfoliative dermatitis the disease process was extensive. The highest eosinophile count was $8\frac{8}{10}$ per cent.

Two of the patients with ichthyosis, one an adult and the other a child, showed a generalized eruption. A blood-count gave the percentage of the eosinophilic cells as $1\frac{2}{10}$ and $3\frac{2}{10}$ per cent.

The eruption in the two cases of prurigo which have come under our observation was general and quite active. These showed a fair degree of eosinophilia, namely, $14\frac{1}{10}$ per cent. and $9\frac{5}{10}$ per cent.

Our results for the most part agree with Canon's findings, that the degree of the eosinophilia depends upon the extent of the disease process. It does not seem to us, however, that this idea is entirely satisfactory, for many cases with large surface involvement do not show an increase in the eosinophilic cells. We are inclined to the belief that the more active the disease process, the higher the degree of the eosinophilia. It will be observed that these conclusions are intermediate between those of Canon and Zappert. With the statement of the latter, that a high eosinophilia is found with a slight tendency to healing, we cannot agree, especially when it occurs in patients in whom the process is active. It has been our experience that such cases show a decided tendency to improve under treatment, and we believe that further investigation will show that an active process with high eosinophilia is of value in enabling us to give a more favorable prognosis.

In this connection it may not be out of place to mention the fact that in sepsis the eosinophilic cells are much decreased in number, and that persistence of these cells is considered a favorable sign.

In nearly all of the blood-specimens, 500 leucocytes were counted. When the proportions of the cells varied greatly from normal, two different stains were used, and often 1,000 leucocytes were counted.

The material for the above report was collected chiefly from the clinic of Dr. A. F. Büchler, at the Presbyterian Hospital Dispensary, to whom I wish to extend my thanks for the use of the cases and for many suggestions.

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XIV.

A HOUSE EPIDEMIC OF PARATYPHOID FEVER.

By Philip van Ingen, M.D., and Lewis Fox Frissell, M.D.

During the past summer an unusually large number of cases of typhoid fever were admitted to the wards of the Presbyterian Hospital. The following four cases, which presented the clinical picture of that disease but failed to show the Widal reaction, are of interest, as the bacteriological aspect was carefully studied and proved them to be of paratyphoidal origin. All four cases developed in the same family and almost simultaneously. Three of the patients recovered and one died. The clinical histories of these four cases are given in detail.

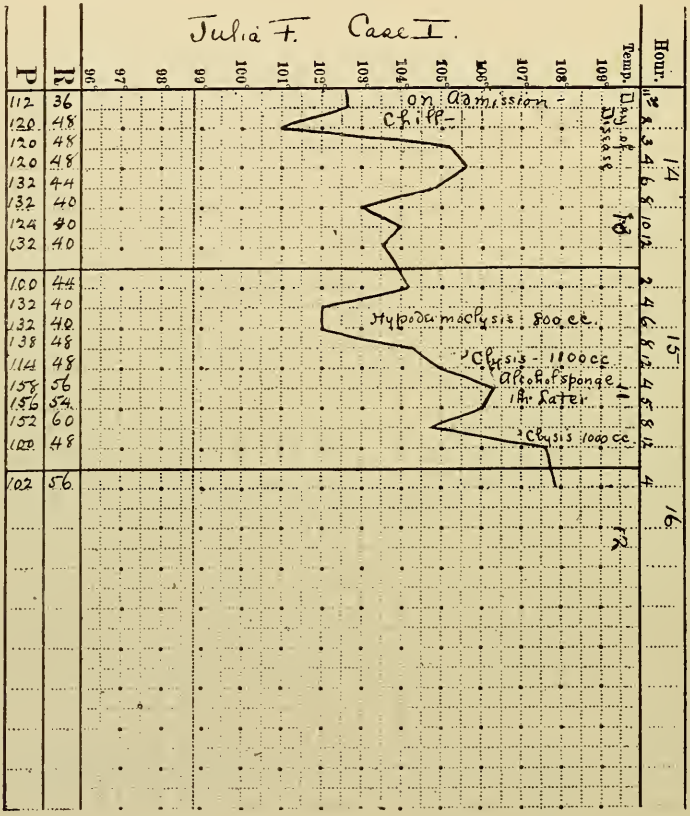
The family consisted of man and wife, three sons and one daughter. They lived on the top floor of a tenement-house, there being one other family on the same floor. These two families obtained their drinking water, which was used unboiled, from a tank on the roof which was filled daily from the main pipe in the cellar. This tank supplied only these two families. They obtained their milk from different sources. Besides the four cases which follow, three cases developed in the other family and a fourth in a man who was a constant visitor at their home.

Case I.—Julia F.; scrubwoman in Department of Health Laboratory; married; aged thirty-nine; admitted to the service of Dr. Walter B. James, October 14, 1903.

A complete past history could not be obtained, as patient was delirious on admission. Her family thought she had always been well and strong, and had never been confined to her bed except during childbirth. All her pregnancies and labors were said to have been normal.

She did not complain of anything until ten days before admission, when she said she did not feel as well as usual, but her only complaint was general malaise and loss of appetite. Six days before admission

she began to suffer from severe frontal headache and constipation. The following day she had a hard, shaking chill, followed by fever and sweating, and began to cough, with scanty mucus expectoration. There was no pain in the side. Her bowels became loose, there being three



or four loose stools a day, exact character not noticed. She kept about at her work as best she could, with continued and increasing fever and prostration, until the night before admission, when she suddenly became wildly delirious and attempted to jump from the window. After a few hours she became much exhausted, and cyanotic, remaining so up till admission. There was a second chill of unknown duration during the night.

On admission to the hospital, temperature was 102.6° F.; pulse, 112; respiration, 36. She was a large, corpulent woman, greatly prostrated and apathetic, very dull and irrational. The whole body was held somewhat rigid; the extremities were cold and there was marked general cyanosis. Respiration was rapid but not labored. The tongue was dry, cracked, heavily coated with brown fur; the pharynx and tonsils dry, congested, but free from exudation; buccal mucus membrane dry and covered with adherent inspissated mucus. There was considerable inequality of the pupils, the left being the smaller, but both reacted normally to light.

The maximum apex impulse of the heart was in the fifth intercostal space five and one-quarter inches to the left of the median line. The right border of the heart percussed at about midsternum. The heart was very rapid and irregular, the sounds very short. No murmurs could be heard at the apex, but at the base a very faint, rough, systolic bruit was heard, with greatest intensity over the pulmonic area. Both basal sounds were of poor quality. The pulse corresponded with the heart action, being rapid, irregular both in force and frequency and of very poor force. The vessel wall was palpable. A few fine, dry râles and many moist râles were heard over both lungs, and from one inch below the angle of the right scapula to the base there was diminished resonance, with breath-sounds feeble but of normal character. No enlargement of the liver was made out, nor could anything be felt at the right costal arch. Percussion revealed no enlargement of the splenic area and the edge of the spleen could not be felt. The abdomen was full, soft, and tympanitic, and palpation did not seem to cause any discomfort. The lower extremities presented many varicosities, with much cyanosis, and there was no Kernig's or Babinski's sign. No rose-spots were visible on the surface.

The urine was of a specific gravity of 1020; contained three per cent. of albumin (volumetrically), with many hyalin and granular casts. Fifty ounces were voided during the first twenty-four hours. The blood showed a leucocytosis of 15,000.

Two hours and a half after admission the patient had a hard, shaking chill, lasting one-half hour, during which she was very cyanotic. Temperature rose to 105.6° F.; pulse, 120; respiration, 48. Early the following morning, fourteen hours after admission, the pulse was 132,

small and thready. The temperature had fallen in two hours from 104.2° F. to 102° F. Hypodermoclysis of 800 c.c. normal salt solution was given and the pulse improved slightly, though it still remained very rapid. A Widal test, made at this time, was negative, and the leucocytes were 19,000.

Later in the day the patient passed into a condition of coma vigil; the pulse became more and more rapid, reaching 158, very small, soft, and thready; respirations were 60. She did not respond to vigorous hypodermic medication or to hypodermoclysis. Cyanosis became more marked, and the temperature rose steadily, reaching 107.8° F. just before death, which occurred twelve days after the first symptoms of malaise and anorexia.

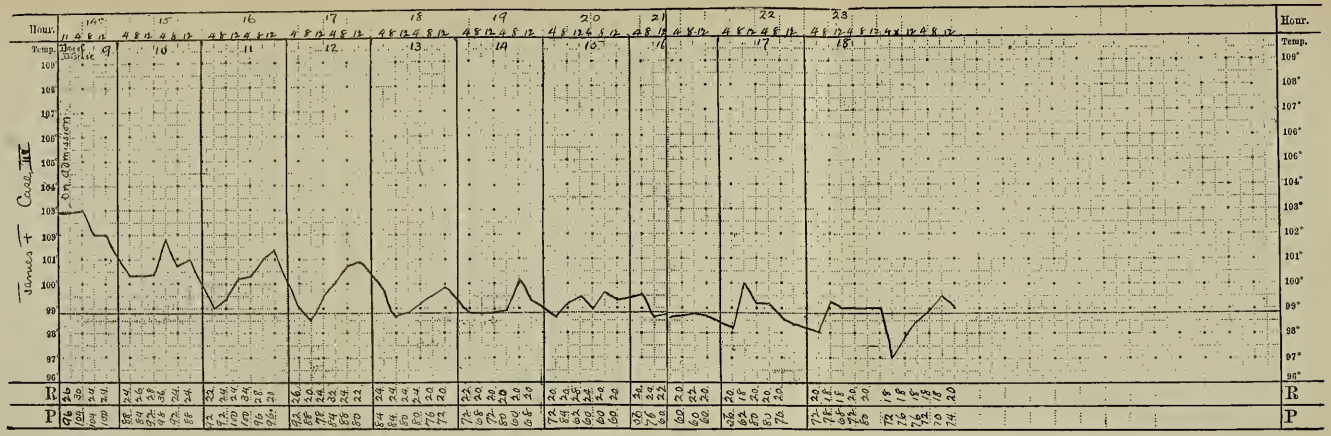
Case II.—Frank F.; school-boy; aged nine; admitted October 14, 1903, to service of Dr. W. Gilman Thompson.

Past history was negative, except for measles several years before.

Nine days before admission he began to feel rather miserable, but did not tell anyone until two days later, when he came home early from school complaining of severe frontal headache and abdominal pain. He went directly to bed, and remained there up to admission. He vomited twice on the two succeeding days, but not after that. The bowels were loose, moving twice each day. Appetite remained good. There was no cough or epistaxis.

On admission, the temperature was 102.2° F.; pulse, 100; respiration, 26. He was a poorly nourished boy; very much prostrated and intensely apathetic. Respiration was a little rapid but not labored. There was moderate pectus carinatum. The tongue was dry, brown, cracked, and heavily coated. The teeth were covered with sordes; the lips dry, cracked, bleeding; the gums soft, red, with several aphthous patches. The pharynx and tonsils were dry and red. All of the superficial lymph-nodes were palpable. The heart was normal and acting well. The pulse regular and slightly dicrotic. Percussion of the splenic area showed it to be enlarged, and though he held the abdomen rather tense the edge of the spleen was felt at the costal arch. Scattered over the surface of the thorax, abdomen, and shoulders were many small, faint, very slightly elevated, pink, erythematous spots.

The urine was of a specific gravity of 1028; contained a very faint trace of albumin, without casts. There were decided diazo and indican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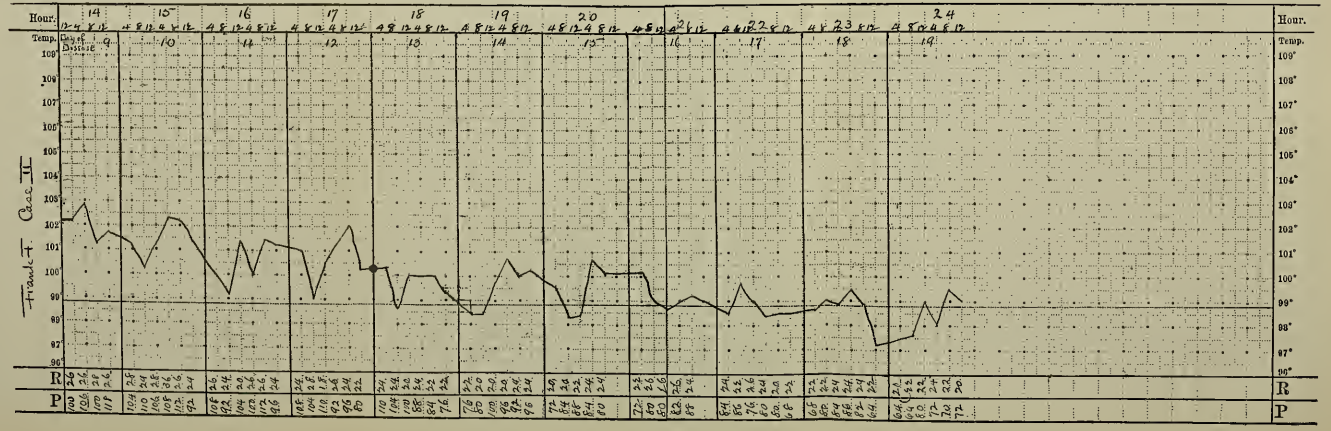
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reactions. The Widal reaction was negative. The leucocytes numbered 9,700.

His course in the hospital was uneventful. Under careful nursing the tongue cleared up almost at once. The temperature fell steadily, reaching subnormal and remaining below 100° on the ninth day in the hospital, the nineteenth day after he first complained of malaise, or the seventeenth day after going to bed. The bowels were inclined to constipation, requiring a daily enema. The Widal reaction was tested fourteen times with negative result. The spleen could be palpated until the thirtieth day, the temperature having been normal for thirteen days. The spots rapidly faded and there was no second crop.

Case III.—James F.; school-boy; aged ten; admitted to the service of Dr. W. Gilman Thompson, October 14, 1903.

The patient's previous history was negative, except for a slight attack of chorea eight months ago. He had been free from symptoms for five months. Eight days before admission, having previously felt perfectly well, he came home from school complaining of severe frontal headache and pain in the shoulders. He felt so miserable that he went directly to bed and remained there up to the time of admission to the hospital. During the first day he vomited three times. There was complete anorexia. The bowels moved three or four times daily. He did not feel feverish, and there was no epistaxis or cough.

On admission, his temperature was 103°; pulse, 96; respiration, 26. He was a fairly well-nourished boy and was only slightly prostrated and apathetic. The tongue was moist, swollen; the edges red; the surface heavily coated with whitish fur. All of the superficial lymph-nodes were palpable. The heart was normal, the pulse of good quality. No enlargement of the splenic area of dulness was made out nor could the edge be felt. Over the surface of the trunk were a few faint erythematous spots.

The urine was of a specific gravity of 1029, and contained a very faint trace of albumin without casts. The diazo and indican reactions were strong. The blood showed 13,000 leucocytes to the c.mm. with a negative Widal reaction.

His course in the hospital was uneventful. The temperature remained under 100° after the fifteenth day except for a slight digestive

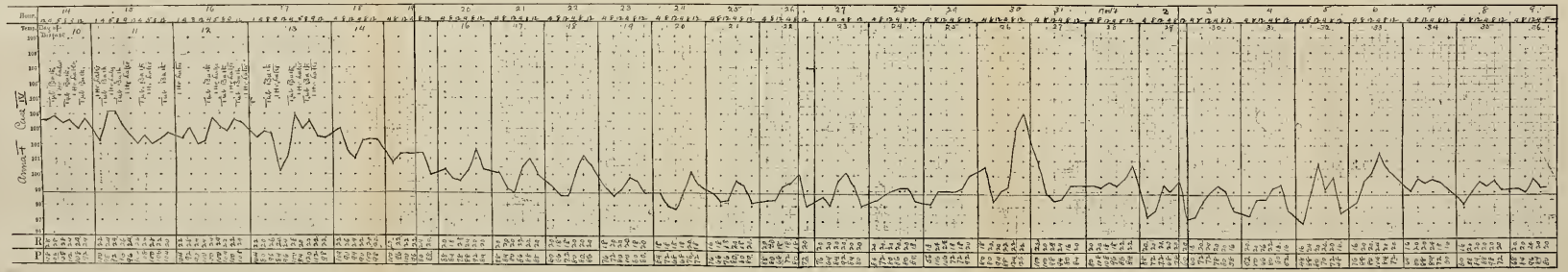
disturbance well on in convalescence. The bowels were free for the most part, only requiring an occasional enema. The spleen was never palpable at any time. The spots faded rapidly and there was no second crop. Fourteen Widal tests gave a negative result. They were taken every two days.

Case IV.—Anna F.; saleswoman; aged seventeen; admitted to the service of Dr. Walter B. James, October 14, 1903.

The patient had never been a strong girl. She had been a frequent sufferer from attacks of tonsillitis, and took cold very easily. For several years she had been troubled with cardiac palpitation and dyspnœa on exertion, and on occasions œdema of the eyelids, headache, and muscæ volitantes, with attacks of vertigo. Eight months previously she had experienced a sudden attack of severe cramp-like abdominal pain preceded by a shaking chill, and followed by fever (105° F.), with nausea, vomiting, severe headache, and profuse sweating. Her bowels were rather loose. The attack only lasted two days.

For two or three years a cough had troubled her, becoming worse, she thought, after her attack eight months ago; and during the past four months she had been losing weight. Her appetite failed; headache was frequent; every afternoon she felt feverish, and a hectic flush was noticed.

On admission to the hospital the temperature was 103.6° F.; pulse, 108; respiration, 28. She was well nourished, rather pale, not at all prostrated or apathetic. Her tongue was inclined to dryness, with red edges, and a heavy coating of white fur down the centre. The cervical, submaxillary, and axillary glands were all enlarged. The maximum cardiac impulse was in the fourth intercostal space three and three-quarters inches to left of median line. There was a distinct presystolic thrill at the apex, and on auscultation a loud, rough, low-pitched, rumbling presystolic murmur was heard, well localized and with considerable accentuation of the second pulmonic sound. There were a few moist râles over the posterior chest and at the bases of the axillæ, but no localized signs of pulmonary trouble could be found. The splenic dulness extended almost to the costal arch in the mammary line, and the edge, sharp and firm, was easily felt half an inch below it. A few small, rose-colored, erythematous spots were scattered over the abdomen and chest.



The urine was of a specific gravity of 1030, and contained a heavy trace of albumin with a few hyalin and granular casts, which latter were only found on a single examination. Indican reaction was heavy.

The patient did very well in the hospital, the temperature remaining under 100° on the nineteenth day, but after that it occasionally jumped up to 100.5° F. once during the twenty-four hours. The bowels were very constipated, requiring a daily enema. On the twenty-sixth day, after an enema had returned with almost no fæcal matter, she was given three grains of calomel in divided doses, and the next morning, the bowels having moved twice during the night, she complained of a severe crampy abdominal pain. During the afternoon her temperature rose to 104° F.; there was slight abdominal tenderness and very slightly increased resistance of the abdominal muscles. The abdomen moved freely with respiration; there was no loss of liver dulness; no peritoneal rubs or other signs of peritoneal involvement. The next morning her temperature was normal, and remained practically so till seven days later, when with some constipation it again rose to 101° F., and the next day to 101.5° F.

Convalescence was otherwise uneventful. At discharge, her lungs were clear and there was no evidence of any tubercular process. The spleen was last palpable on the thirty-sixth day. There was but one crop of spots. The Widal reaction was tested twelve times with negative results.

These cases present several features which it may not be amiss to briefly call attention to in summary:

The Sudden Onset.—In two cases the patients were sick enough to go to bed the first day that the symptoms appeared. A third patient had malaise for two days only before giving up, while the fourth, the mother of the family, all the rest being confined to bed, kept about as best she could till she became delirious.

Chill occurred in the two adult cases, in one within a few hours after the appearance of the first symptom.

The Short Duration.—In the three cases which ended in recovery, the temperature was subnormal in the morning and remained under 100° throughout the day, on the fifteenth, sixteenth, and twenty-first days respectively. The fatal case terminated with hemorrhage on the twelfth day after the first symptom appeared.

The Mildness of the Cases.—Except in the fatal case the patients never appeared seriously ill, except Frank F., Case II, who, however, was bright and cheerful three days after admission.

Freedom from Complications.—The three cases which terminated favorably were entirely free from any complications, unless the two rises of temperature in Case IV, Anna F., which were associated with intestinal disturbance, be so considered.

PATHOLOGICAL REPORT.

Of the four cases above described, one proved fatal. The autopsy was performed by Dr. Tuttle ten hours after death, and to him we are indebted for the following autopsy record:

J. F., autopsy, October 16, 1903. The heart is moderately hypertrophied. *Lungs:* Normal. The gall-bladder is full of thick, glairy fluid; the wall is a little thickened and shows evidence of cholecystitis. There are several calculi, one as large as a walnut; another occludes the opening of the cystic duct, preventing the escape of bile from the gall-bladder. *Liver:* Normal. The spleen is not enlarged. The consistence is soft. On one edge is a nodule three-quarters of an inch in diameter, of a whitish color. It contains a yellow encapsulated mass of gelatinous consistence. *Kidneys:* The capsules are free; the surface is smooth; the cortex is pale; the striations are not distinct; the stellate veins are prominent. *Intestines:* The mucous membrane appears normal except just above the ileocæcal valve, where there are several ulcers. These present a deep, punched-out appearance, extending in some cases to the peritoneal coat. The edges show no induration or other evidence of inflammatory action. The Peyer's patches appear normal. The large intestine contains a large amount of blood throughout its entire extent. The mesenteric glands are enlarged.

The diagnosis made at autopsy was in accordance with the above findings. Typhoid fever, intestinal hemorrhage, cholecystitis, gallstones.

In view of the rarity of reported autopsies in paratyphoid, none of which, except a mixed infection, showed intestinal lesions, it may be of interest to point out in detail the salient features of our case, and wherein it differs from a typical typhoid.

1. No changes were apparent in the Peyer's patches, which were normal throughout the entire intestine. While it is possible that of the few existing ulcers each occupied the entire site of a Peyer's patch, there was no evidence of this in the surrounding tissue, and if this be the case we must assume that the entire area had sloughed away, a theory which seems improbable in view of the fact that the patches were elsewhere normal.

2. The few ulcers present had a punched-out appearance, somewhat resembling an ulcer of the stomach with no induration of the edges.

3. The mucous membrane of the intestine showed no catarrhal change.

4. Absence of enlargement of the spleen.

At the autopsy, cultures were made from the spleen in the usual manner, *i.e.*, sterilization of the surface with a hot iron and taking the cultures from the underlying parts with the platinum needle.

Two plates in His's medium were made, as well as two ordinary bouillon cultures. Plate I, which was somewhat overgrown, showed very numerous small colonies about the size of a pin-point of irregular outline with threads growing out into the medium. In Plate II the colonies were of larger size, of a gray, granular appearance, and very irregular outline. In short, both forms, but particularly those first described, resembled colonies of the bacillus typhosus.

Transplants into bouillon showed in the hanging drop actively motile bacilli rather short and thick, sometimes joined together in threads and almost resembling a chain of streptococci swimming across the field.

The following plants were made in media to test gas and indol production, etc. In each transplant a single loop of a fresh culture was used.

Lactose bouillon, 72 hours in thermostat ..... No gas.
Glucose " " " thermostat ..... Abundant gas.
Dunham's peptone solution, 72 hours in thermostat..... No indol.
Milk, 7 days in thermostat ..... No coagulation.
Litmus milk, primary acidity followed in seven days by a terminal alkalinity.

Analysis of the above reactions shows that our bacillus differs from the colon by its inability to produce indol, its failure to coagulate

milk, and the fact that no gas is produced in lactose. From the typhoid bacillus it is differentiated by its fermentation of glucose with the production of gas.

It is evidently, then, one of the so-called intermediate forms, and the question arises, Has it a causal relationship to the disease of which our patient died?

We have seen that the blood-serum of our cases though repeatedly tested in low dilution (1–20, the laboratory standard for negative results) failed to agglutinate typhoid bacilli; in other words, gave no Widal reaction. Our bacillus, when tested with the serum of a typhoid patient which gave an immediate reaction in a dilution of 1–50 with the laboratory typhoid culture, gave in a dilution of 1–20 no reaction at the end of two hours. With the blood-serum of the three other cases in the same family, however, the reactions were as follows:

A. F., serum, 1–50 dilution.....reaction immediate.
J. F., " " " .....reaction in 3 minutes.
F. F., " " " .....reaction in 5 minutes.
In lower dilutions, 1–20, both the last cases gave immediate reactions.

Through the courtesy of Dr. Park, of the Health Board, the blood-serum of two other patients was obtained. These cases were members of a family of five living directly across the hall, in which there were three cases of prolonged fever of a typhoidal type, as well as one case in a man who was a constant visitor of the family. None of these cases came under our personal observation. The blood of both of those obtained reacted promptly in a dilution of 1–50. Unfortunately, the blood of the other two could not be obtained.

We were also enabled to test our serum with six strains of paratyphoid bacilli furnished us through the kindness of Dr. Park. Of these, three—Strong, Kurth, Hünerman—all β bacilli, gave an immediate reaction, while Buxton No. VII Buxton, from normal fæces, and Schottmüller, members of the α group, did not agglutinate even in low dilutions. It may be of interest in passing to say that the fatal paratyphoid cases heretofore reported have been members of the β group, as ours was proved to be from its terminal alkalinity in litmus milk.

We are therefore justified in considering our bacillus a paratyphoid,

and one standing in causal relationship to the epidemic in question. As the suggestion that our cases might be paratyphoid was made late in the disease, practically in the convalescent stage, no attempt was made to isolate the bacillus from the blood. Efforts to obtain it from the urine were without result. Nevertheless, the conclusion seems justified that we have to deal with a paratyphoid epidemic consisting of eight cases, infected at or about the same time and limited to two families, who occupied the top floor of an apartment-house.

The source of infection remains somewhat obscure. One possible theory is that all were directly or indirectly infected by the one fatal case, that of the woman who was employed in the laboratory of the Board of Health. It seems, however, that she had no access to the rooms where the paratyphoid cultures were kept. There was no common milk or food supply for the two families in question, which practically excludes infection from those sources.

The drinking-water, however, came from a tank on the roof, used only by the families on the top floor. The water was daily pumped into it from the cellar, and was invariably very muddy. Unfortunately, before bacteriological examination of the water was made, the tank had been thoroughly cleaned out by the landlord, who had heard of the matter. Consequently, the bacteriological examination proved negative in result. Nevertheless, this seems the most probable source of infection.

In conclusion, we wish to express our gratitude to Dr. G. A. Tuttle, under whose direction this work was done, for his many valuable suggestions.

XV.

A REPORT UPON MALIGNANT ENDOCARDITIS, WITH A COLLECTION OF THIRTY-TWO CASES.

By Montgomery H. Sicard, M.D.

Boullard, in 1824–32, was the first to show a form of acute endocarditis accompanied by pyæmic symptoms; he did not, however, appreciate any relation between the endocardial lesion and the general septic condition of the patient. Stenhouse Kirkes, in 1852, showed the malignant form of endocarditis, and he considered the typhoid type of symptoms due to an alteration in the blood produced by circulating granular masses detached from the valves. Virchow showed the embolic nature of the plugs occurring in the arteries; also he demonstrated a case of puerperal sepsis in which there was peritonitis, with diphtheritic deposits in the intestines and coagulated masses on the mitral valve. He looked upon the process as of possible parasitic origin.

Many investigators, as Hayem, Dugues, and Desplats, considered the valvular lesions and the lesions in other organs as local manifestations of a general infection. Winge was the first, however, to describe microbes found on the valves and in the metastatic infarcts; these he described as chains of small rods or of small round granules. Heïlberg also found organisms of a similar character in a case of endocarditis in a puerperal state; he excised particles of the valves and injected them into rabbits, but without effect. Numerous inoculation experiments followed, and Birch-Hirschfeld succeeded in causing panophthalmitis in three rabbits by inoculation with fragments of valve deposits.

From 1885–1888 numerous interesting observations were published, most important of them being those of Netter, Weichselbaum, Orth, Wyssokowitsch, and Rosenbach. The investigations showed that by injecting into the external jugular vein pyogenic organisms, streptococcus pyogenes, staphylococcus pyogenes aureus, and others, an

artificial endocarditis could be produced. The experiments were more apt to be successful if the valves or arterial surfaces were injured before the introduction of the germs, the injury being caused by a sterilized stylet passed through the carotid artery into the left ventricle (Rosenbach). Netter and Ribbert think a previous lesion not necessary. Dreschfeld has succeeded in producing the disease without previously wounding the valves. The resulting organisms were found on the valve surface and in the metastatic emboli.

Most recent investigators are of the opinion that the difference between *simple acute* and *ulcerative* endocarditis is one of degree, depending upon the virulence of the invading organisms or their toxins, or susceptibility on the part of the patient. Bacteria are found in the valves of both forms; almost always in the ulcerative variety, often in the simple form, and the same organisms are found in both. Weichselbaum says: "Acute endocarditis chiefly affects the valves, especially of the left heart, and appears to be practically always due to bacteria; the micro-organisms affect the valves either primarily or are derived from other organs. An anatomical distinction between ulcerative and verrucose forms can be drawn only according to the *destructive* character of the inflammation. The difference is only of degree, dependent upon the quantity and the virulence of the bacteria. In the *ulcerative* variety, the *necrotic destruction and the surrounding inflammation* is much more extensive than in the other, and leads to the formation of ulcers, erosion, miliary aneurisms, and perforation of the valves." Dawson Williams thinks that when the right heart is attacked it is by secondary infection.

Harbitz records 39 cases which he considers of the infectious type. In 6 cases the ulcerations had healed and presented outgrowths on the endocardium; at the edges of the vegetations masses of bacteria were aggregated, but cultures remained sterile. He makes two classifications pathologically: one with vegetations and excrescences on the endocardium, the other with destruction of tissue and ulceration. Osler says that in seventy-five per cent. of cases the infectious form is engrafted upon a previous endocarditis; in his collection of 209 cases the tricuspid valve was involved alone in 19, the pulmonary in 15, aortic alone in 53, mitral alone in 17, aortic and mitral together in 41, heart-walls in 33, and the right heart alone in 9. Out of 802

benign cases in the Munich statistics, the right heart alone was affected in 3.25 per cent. In 44 cases of the *ulcerative* type, the right heart was affected in 15.91 per cent. (Thayer and Lazear).

These two observers also report 16 collected cases of gonorrhœal origin; of these, the right heart was affected in 10.

Jackson reports 59 cases, with autopsies in 43. The mitral valve alone was affected in 15, the aortic in 9, both together in 10, and the right heart showed lesions in 6 cases. Small abscesses of the brain and purulent meningitis were often seen, and organisms resembling cocci morphologically were frequently found in sections of the endocardium. Blood-cultures were taken in 23 of Jackson's cases; streptococcus was found in 8; micrococcus lanceolatus in 5; staphylococcus in 3; colon in 1; streptococcus and staphylococcus together in 1, and streptococcus with unknown organisms in 1. In 28 cases investigated by Lenhartz, 16 gave growths in blood-cultures.

The organisms most frequently found are the streptococcus pyogenes, staphylococcus pyogenes albus and aureus, pneumococcus of Fraenkel or diplococcus lanceolatus, gonococcus, typhoid bacillus, bacillus of tuberculosis, bacillus of diphtheria, and the colon bacillus. The first two are found in cases in which the endocarditis is apparently primary; in septic and pyæmic conditions, as wounds, abscesses, the puerperal state, erysipelas, etc.; in cases where there is a pre-existing valvular lesion due to previous rheumatic disease. These two organisms have also been found upon the valves in cases complicating typhoid fever, gonorrhœa, diphtheria, etc., showing a type of mixed infection. The diplococcus lanceolatus has been found mostly where croupous pneumonia or meningitis were present, although two cases are cited in this series where neither lesion existed, but a previous endocarditis had occurred.

In most cases the micro-organisms found on the valves or in the interstitial tissue have also been found in the infarcts and metastatic abscesses; and many times in the circulating blood during life.

ETIOLOGY.

Dreschfeld says: "The following types of malignant endocarditis are recognized: (*a*) Primary. (*b*) As a complication of septic diseases. (*c*) As a complication of pneumonia and meningitis. (*d*) As a mixed

infection secondary to the acute infectious fevers, to rheumatic endocarditis, or to a sclerosis of the valves." The primary cases are admittedly rare. Pneumonia is a frequent cause, as is meningitis, also septicæmia from whatever origin, rheumatic fever, and less frequently typhoid fever, influenza, diphtheria, scarlet fever, tuberculosis, variola, and measles.

The disease is rare among young children. Osler gives but three cases in his collection of 209. The records of the Children's Hospital at Melbourne furnish but one case in ten years. Davies finds but one case in the "Transactions of the Pathological Society" (London). Only one case appears in the records of the London Hospital for Sick Children from 1870 to 1890, and S. S. Adams reports but one case in the Children's Hospital, Washington, D. C., since 1870.

Roussel reports a case in a child of nine years with greatly enlarged spleen (one and a half inches below umbilicus) and leucocytosis of 44,000, following convalescence from typhoid fever. Heart murmurs occurred only just before death, which was suddenly induced by cerebral embolism. At post-mortem examination the diagnosis was verified, and typhoid lesions were found in the intestine.

S. S. Adams has collected all the cases reported in children under fifteen years of age—46 in all: 3 congenital, 1 of eight months, 1 of ten months, 1 of eleven months, 3 of three years, 2 of four years, 3 of five and a half years, 2 of six years, and the others of seven and over. The diseases preceding or accompanying this condition were: Maternal erysipelas and fœtal infection (cultures from the cord showed streptococci); malaria, 1 (æstivo autumnal); acute miliary tuberculosis, 1; vaginitis, 1; remitting fever, 1; rheumatism, 3; chorea, 2; rheumatism and chorea, 1; typhoid fever, 2; empyema, 1; trauma, 1; otitis media, 1; old cardiac disease, 5; caseous tubercle, 1; diphtheria, 1; influenza, 2; erysipelas, 1; tonsillitis, 1. The rest are not given.

Of the 46 cases, the heart-wall was affected in 6; the tricuspid valve in 5; the pulmonary valve in 2. One had a patent foramen ovale, and in the others the left heart was the seat of inflammation.

No cases have occurred in young children in the Presbyterian Hospital during the last ten years.

Group I.

The following five cases are a collection of staphylococcus infection; one more has occurred in the Hospital records, but cannot be entered here.

Case I.—Aged thirty-seven; male; attendant; admitted February 3, 1900; died February 9, 1900.

Family History.—Father and sister died of pulmonary tuberculosis.

Previous History.—Measles and pertussis as a child; no specific history; drinks moderately; has never had rheumatism.

Present Illness.—Began one week ago; previous to this time he had been perfectly well, when suddenly he vomited two to three spittoons full of blood; the first blood was bright, the last was dark. Following this he had pain over the liver region and also under the left costal margin; this pain disappeared after two or three days. After the vomiting he was considerably prostrated, but went to work in two days. Three days ago he could not void his urine and it was drawn from him; occa-sionally he has to rise at night to void urine.

Physical Examination.—February 3. *Heart:* Slight apex impulse in normal position; no murmurs made out; there is some tension and thickening of vessel wall. *Lungs:* Normal. *Liver:* Normal. *Spleen:* Not made out. *Abdomen:* Negative.

On Admission, pulse, 84; respiration, 20; temperature, 98°. *Urine:* Normal.

January 29. Last night patient had three convulsive seizures, with frothing at the mouth, followed by stupor. Catheterized specimen of urine shows fifteen per cent. of albumin, by volume. Each attack lasted about fifteen minutes. The patient this morning is irrational, pulse irregular, of increased tension, and the aortic second sound is loud and sharp. There is no œdema. Blood-pressure, 130 mm. hg.

February 1. Patient is very noisy and delirious. *Blood-culture* shows pure growth of streptococcus pyogenes aureus. He lies with head much retracted and neck apparently stiff. Delirium is active and noisy. Kernig's sign is present. *Heart:* Apex is in fifth space just within mammary line, left limit of dulness corresponds. There is no increase of dulness to right. Endocardial sounds normal. Over a

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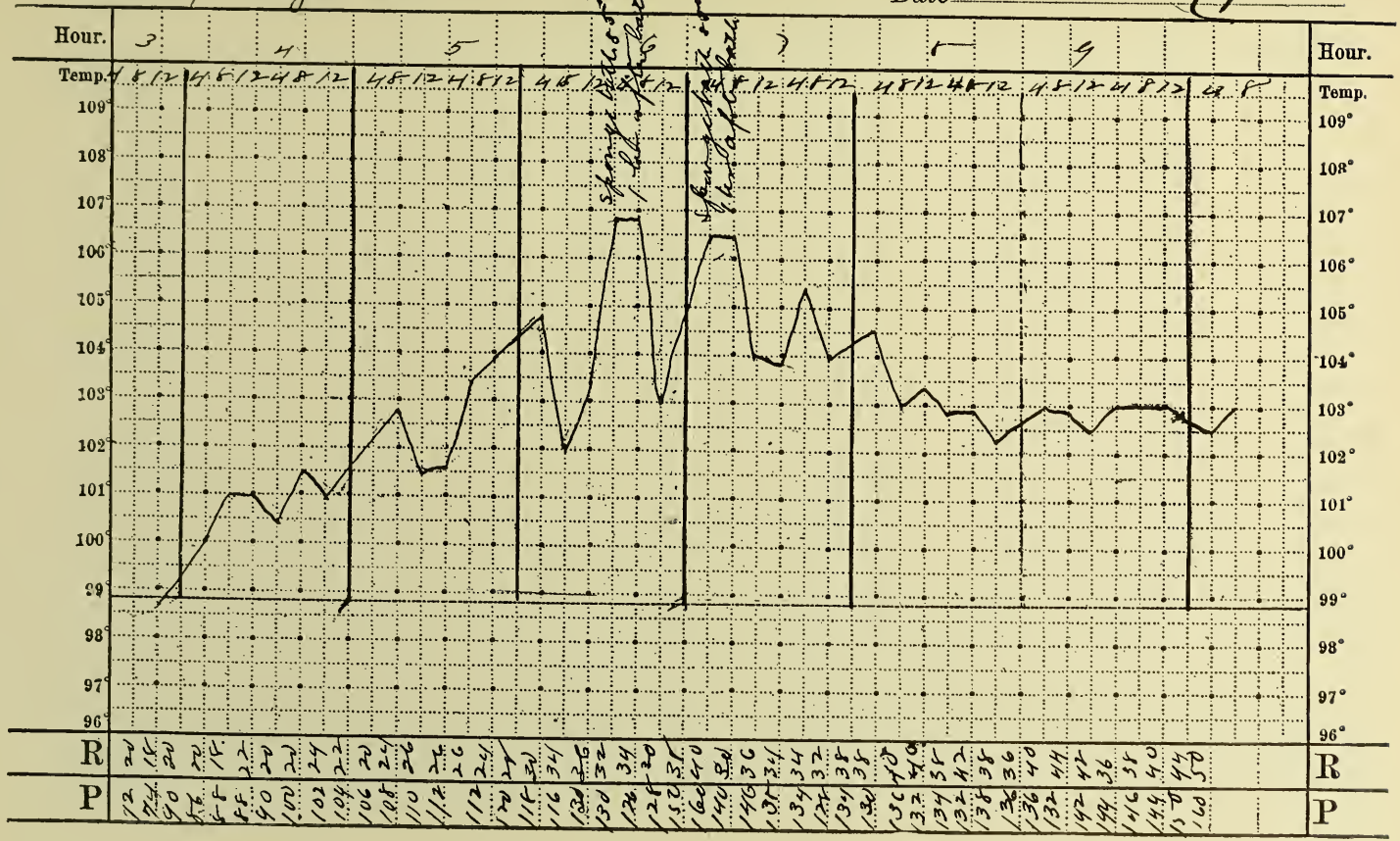

small area in the parasternal line at third space is a harsh systolic sound, apparently extracardial. *Lungs:* Normal, except for fine, moist crepitation at bases.

Leucocytes: 10,000 per c.cm.

February 2. Neck is less stiff. Pericardial friction rub is still heard. Kernig's sign is still present. Pulse, 120. *Urine* contains red blood-cells; otherwise normal.

February 9. Patient is quiet and conscious, is much weaker and is evidently *in extremis*. Signs same as before. *Blood examination:* No Widal reaction. The temperature rose irregularly to 107° on the 6th, 106° on the 7th, and then fell to 103°, where it remained. There were no chills.

Autopsy.—Heart: Weight, nine and a half ounces. *Pericardium:* Normal. *Valves:* Very small, white, soft vegetations on mitral. *Muscle:* Normal. *Lungs:* Congested. *Spleen:* Normal. *Kidneys:* Normal. *Cultures* from the spleen and brain showed staphylococcus pyogenes aureus.

Case II.—Aged twenty-five; housewife; admitted May 7, 1899; died May 9, 1899.

Family History.—Father died of apoplexy.

Previous History.—The patient does not remember children's diseases. No alcoholic or specific history. At times she has suffered from dyspnœa and palpitation; never any dropsy. Fourteen months ago she had a slight attack of rheumatism.

Present Illness.—About five days ago she was exposed to a draught, when she suddenly felt dizzy and developed high fever, and has been confined to bed ever since. She vomited once. For several days there has been pain and tenderness in many of her joints. Three days ago blood-red spots appeared upon her feet and legs; on day of her admission she was taken with severe epistaxis.

Physical Examination.—May 7. *Heart:* Apex is in normal site; there is a systolic murmur at apex transmitted a short distance to the left. Pulmonary second sound is accentuated. *Pulse* is rapid, soft, small, and of poor force. *Lungs:* Negative. *Liver:* Normal. *Spleen* not made out. *Extremities:* There is tenderness in ankles and knees, but no œdema or swelling. *Surface:* On breast, shoulders, legs, and feet are numerous petechial spots, varying in size from pin-head

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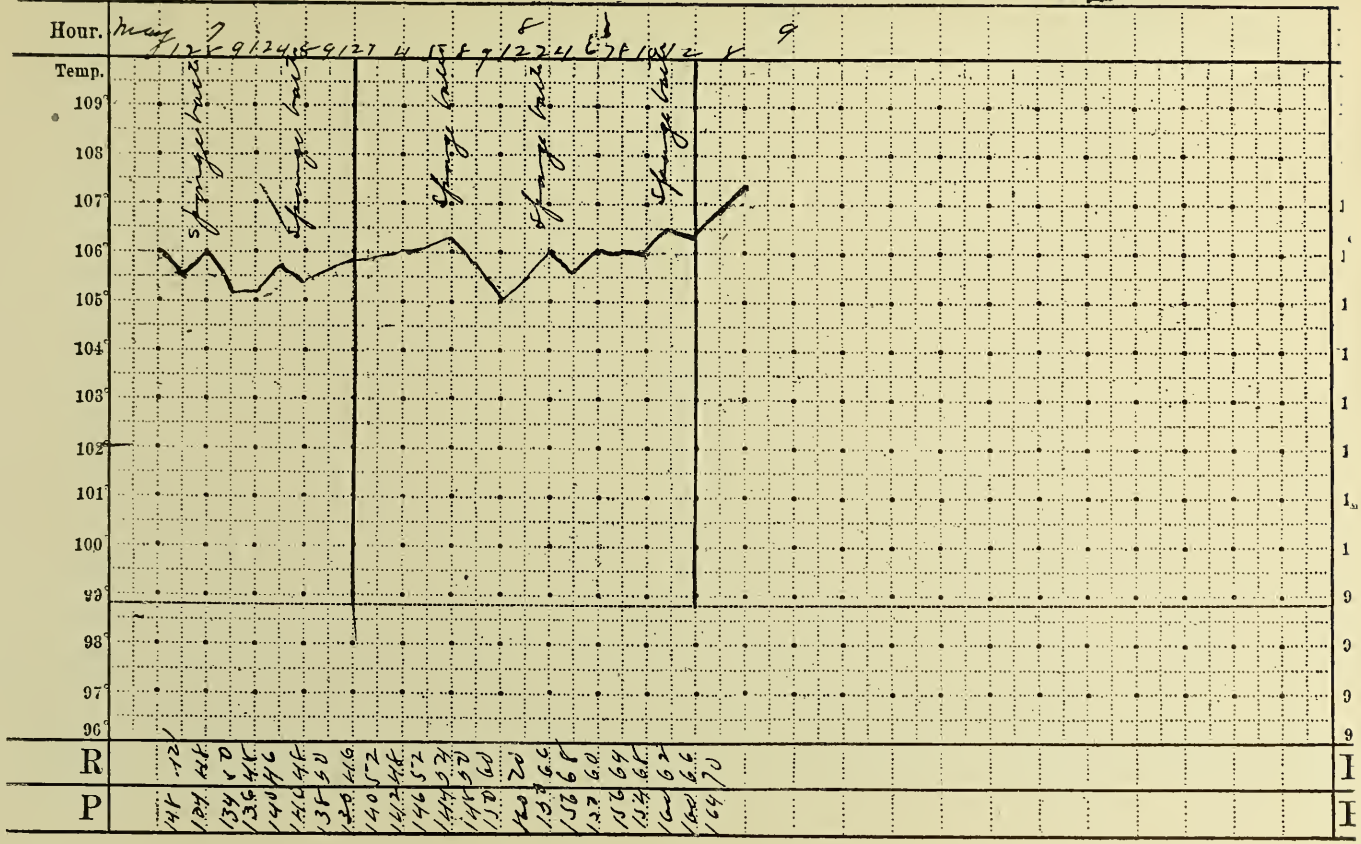

to a dime; some are bright and others dark; many are shotty to the feel.

On Admission, pulse, 148; respiration, 42; temperature, 106° F. *Urine:* Normal.

May 8. Patient is failing; temperature is continuous, is rising steadily; pulse is imperceptible; delirium is marked; many new spots have appeared. *Blood: Leucocytes*, 19,000 per c.cm. *Culture:* Abundant growth of staphylococcus pyogenes aureus. *Temperature* has been high and continuous—105° to 106° throughout. *Died* May 9. No autopsy could be obtained.

Case III.—Aged thirty-one; female; admitted January 3, 1900; died January 6, 1900.

Family History.—No history of tuberculosis or neoplasm. Mother has general œdema and asthma.

Previous History.—The patient had scarlet fever at twelve years of age, without sequelæ; has been troubled with attacks of diarrhœa from time to time, never, however, confining her to bed. Attacks last about one week and then are checked by treatment.

Present Illness.—For a week past she has felt somewhat prostrated, but has continued at work; she has had headache almost constantly. Three to four watery stools a day, with mucus or blood. She has had considerable backache; no epistaxis; no nausea; no vomiting; no cough.

Physical Examination.—January 4. *Heart:* Apex impulse is in the normal position; action is rapid, regular, and forcible. A blowing, systolic murmur is heard over the pulmonary area, also over aortic area, though with less intensity, and down right sternal border. Both second sounds at base are loud. *Pulse* is small, rapid, regular; no increase in tension. *Lungs:* Normal. *Liver:* Apparently normal. *Spleen:* Percusses large; edge is felt just at free costal margin. *Surface* shows erythematous spots typical of enteric fever.

On Admission, pulse, 112; respiration, 24; temperature, 98°. *Blood:* No Widal reaction; Leucocytes, 22,000 per c.cm.

January 5. Condition remains the same; patient can retain no food; she is perfectly rational; neck not rigid; physical examination as before. *Blood-culture:* Abundant growth of staphylococcus pyogenes albus.

January 6. *Heart* is very rapid; condition of embryocardia exists. *Urine* contains no albumin, but a great many granular casts. *Temperature* rose to 103° on the 5th, and then fell; its general course has been low. *Pulse*, 120. *Died* January 6. No autopsy could be obtained.

Case IV.—Aged eighteen; housewife; admitted February 17, 1902; died February 21, 1902.

Family History.—Negative.

Previous History.—She was a premature child (seven (?) months). As a child she had measles, scarlet fever, diphtheria, and pertussis. At three years of age she had inflammatory rheumatism, which confined her to bed several weeks. At six she had typhoid fever. Drinks five or six cups of coffee a day; not alcoholic. At time of her first pregnancy she began to have palpitation of the heart, precordial pain and dyspnœa. Before that time her general health and strength were fairly good; during her following pregnancies she showed symptoms of uræmia.

Present Illness.—Eleven weeks ago she became markedly weak, had attacks of dyspnœa and palpitation of heart, with precordial pain. She was frequently nauseated, and occasionally she vomited. Bowels have been loose, moving several times a day. Urine diminished, dark, and painful upon passing; shortly after, extremities began to swell; after a week or ten days these symptoms subsided and she was able to be up. Seven weeks ago above symptoms all returned with considerable severity, and still persist.

Physical Examination.—February 17. Patient presents a moderate degree of exophthalmos. *Heart:* Apex impulse (maximum) is in sixth space, five inches to left of midsternal line in anterior axillary line; left limit of dulness corresponds. In third and fourth spaces the right limit of dulness is one inch to right of right sternal margin. Action is irregular in force and frequency. First sound at apex is replaced by a blowing, systolic murmur transmitted to axilla. Sounds at base are of poor quality; pulmonic second is not accentuated. In fourth and fifth left spaces, and heard to right of sternum, is another systolic murmur of slightly different quality from the apical murmur, and believed to be tricuspid. *Pulse* is irregular, of fair force, small; no increase of tension or arterial thickening. *Lungs* give signs of fluid in the left pleural cavity. *Liver:* Edge is felt on level with umbilicus;

surface is smooth, and palpation is painful. *Spleen:* Percusses large, and edge is felt one-half inch below costal arch. *Abdomen* prominent; walls œdematous; there is shifting dulness in the flanks; fluid wave can be made out. *Extremities:* Lower, marked œdema of both with cyanosis.

On Admission, pulse, 84; respiration, 32; temperature, 104°. *Urine:* Bloody; specific gravity, 1014; acid; sugar, none; albumin, a trace. *Microscopical Examination:* Much blood. No indican.

February 18. *Blood:* Leucocytes, 31,000 per c.cm. *Culture from Blood:* Several orange-yellow colonies in each tube of blood-serum. Microscopical examination shows staphylococcus pyogenes aureus. *Temperature* has been running from 103° to 104°, continuously high. *Pulse,* 90 to 110.

February 20. *Leucocytes,* 37,000 per c.cm. *Died* February 21. Autopsy not obtained.

Case V.—Aged thirty-six; male; butcher; admitted October 31, 1901; died November 14, 1901.

Family History.—Negative.

Previous History.—The patient had measles as a child; never a pronounced attack of rheumatism, although about ten years ago his joints were a little painful and stiff for a time. Alcoholic history is very slight. A heavy smoker. Gonorrhœa four years ago, no sequelæ, and never any return of discharge; denies syphilis.

Present illness began three and a half months ago, when patient went to the sea-shore. He felt tired and listless all the time, and lacked energy. Returned to the city two months ago, and since that time has been growing worse. After exertion his breathing is labored; his feet have been swollen almost all the time; he has a constant dry cough, and occasionally has sharp twinges of pain in the precordial region and is tender beneath the costal margins. He has had no gastric symptoms. Bowels have been regular; urine not increased in quantity. For the past two months he has been able to work but a few days. For two weeks his condition has been poor; dyspnœa is constant and severe. Three weeks ago a red eruption appeared on the lower limbs, but disappeared at the end of a week. Four days before admission the eruption again appeared on inner side of thighs, blood-red, legs becoming stiff and swollen up to the thighs.

Physical Examination.—November 1. *Heart:* There is a diffuse heaving impulse in fourth, fifth, and sixth spaces to left of sternum, and marked epigastric pulsation. Apex impulse is in sixth space, five inches to left of midsternal line; left limit of dulness corresponds; right limit is one finger's breadth to right of sternum. Action is regular, forcible; there is a very loud, blowing, systolic murmur, with maximum intensity at apex, and transmitted into axilla; it is also heard over the entire precordium, and over the whole chest with less intensity. At the base is a blowing diastolic murmur, of maximum intensity behind the sternum, opposite the second rib, and transmitted up and down the sternum. Pulmonic second sound is accentuated and reduplicated. *Pulse* is soft, Corrigan in character, and vessel wall is thickened. *Lungs* show evidence of congestion. *Liver:* Edge is indistinctly felt three inches below; surface is easily palpable, smooth, and tender. *Spleen:* Percusses large; edge is indistinctly felt. *Extremities* show moderate clubbing of finger-tips, and œdema of lower limbs. *Surface:* Over inner surface of thighs is a fading hemorrhagic rash, dark brownish-purple in color; on both thighs and lower region of legs are numerous petechiæ.

On Admission, pulse, 168; respiration, 20; temperature, 100°. *Blood Examination* shows: Leucocytes, 10,600 per c.cm.; red cells, 4,200,000 per c.cm.; hemoglobin, eighty-five per cent.; color index, one. *Urine:* Amber, clear; specific gravity, 1024; acid; sugar, none; albumin, a trace. *Microscopical Examination:* A few hyaline and granular casts.

November 10. *Temperature* continues irregular, but not higher than 101°; scattered over back and extremities are very numerous petechial spots. *Heart:* Apex in sixth space in midaxillary line; murmur is loud and heard over whole chest. Condition of patient is worse; he is losing ground. *Blood:* Leucocytes, 27,000 per c.cm.; red cells, 3,912,000 per c.cm. *Culture* shows staphylococcus pyogenes aureus.

November 14. Patient collapsed this A.M.; pulse became weak; hypodermoclysis given, with but slight response. Condition very poor. Died November 14. No autopsy could be obtained.

Group II.

The following three cases constitute a group of infection by the micrococcus lanceolatus. The first two were reported by Dr. Walter B. James in the Presbyterian Hospital Report of 1898, and are here entered through his courtesy. One more case has been collected, but cannot be reported in this series.

Case VI.—Aged nineteen; nationality, German; admitted May 1, 1897; died May 28, 1897.

Pathological Diagnosis.—Malignant endocarditis; complications, infarctions in kidneys, liver, and spleen.

Family History.—Negative.

Personal History.—The patient has generally been in good health. No miscarriages. She has not menstruated since January 23, although she does not think she is pregnant. No tuberculous history. Her present illness began three months ago, with a mild attack of inflammatory rheumatism in the hands and feet; this continued on and off until a few weeks ago. She did not go to bed on account of the rheumatism. For the past two weeks she has been troubled with dyspnœa and palpitation and has become very anæmic. She has been confined to bed for one month on account of these symptoms. Two days before admission she had sudden loss of power in right arm and leg, with complete aphasia; this condition has cleared up somewhat on admission. She was told by a physician two months ago that she had organic heart trouble.

Physical Examination.—May 2. *Heart:* The apex impulse is in its normal position; its action is rather irregular; it occasionally intermits; there is a very loud, harsh, systolic murmur over the mitral area transmitted into the axilla, and heard all over the back; there is a systolic murmur at the base, loudest over the pulmonary area; there is marked accentuation of the pulmonic second sound; in the second left interspace a distinct thrill can be felt corresponding to the end of diastole. *Pulse:* Soft, rather small. *Lungs:* Normal. *Liver:* Normal. *Spleen:* Percusses large; edge is not felt. *Abdomen:* Held rigid; seems to be generally hypersensitive, especially over region of liver. *Extremities:* There is some impairment of power in the right upper and lower extremity. The reflexes seem about normal; she cries out loudly on the slightest irritation applied to the extremities.

May 3. There is slight irregularity of the pupils, the right one being larger than the left. The impairment of power in the right arm is much less marked. She is still hypersensitive over the right leg, and to a certain extent over the left.

Urine: Albumin, six per cent., no casts. There is no œdema. The loss of power in right arm and leg is still evident. There is one small ecchymosis in the middle of the inner surface of the right upper arm. The pulse is rapid, quick, and soft. *Temperature* is running irregularly from 101° to 103°, without chills. *Blood:* Red cells, 2,546,000 in c.mm.; white cells, 14,000 in c.mm.; hemoglobin, forty per cent. (Fleischl). A specimen of blood was drawn from the median basilic vein and distributed among seven Loeffler blood-serum tubes. They showed a growth of the micrococcus lanceolatus.

May 12. The irregularity of the pupils is rather more marked; hypersensitiveness of right foot and leg is very marked; paralysis of right arm and leg seems rather less.

May 13. Her condition has grown worse; general appearance is not so good; she takes food with difficulty. *Blood:* Red cells, 2,150,000; white cells, 7,000. *Urine* in twenty-four hours, fourteen ounces.

May 14. She is very drowsy and has difficulty in speaking. *Blood:* Hemoglobin, forty-three per cent.

May 25. The condition has remained about the same; at times the movements from the bowels are involuntary. *Temperature* is still irregular, 104° to 105°. *Blood:* Red cells, 1,806,000; white cells, 10,000; hemoglobin, forty-three per cent.

May 28. The patient died, having grown gradually weaker, the pulse becoming more and more rapid and feeble.

Autopsy, May 28, thirteen hours after death. *Pericardium:* Normal. *Heart:* Weight, fourteen ounces. The mitral valves are covered with a thick fringe of vegetations which extend upward on the anterior surface of the auricle, forming a thick patch, also downward on the surface of the ventricle, as minute scattered tubercles. The surface of the vegetations is rough and ragged, but apparently not ulcerated. The heart-muscle is mottled with pale areas. The pleura is normal. *Left Lung:* There is marked œdema; the lung tissue is rather firm and tough. *Right Lung:* The same. *Liver:* Weight, sixty-two ounces; in consistence is firm, its surface smooth; section shows congestion. *Spleen:*

Weight, fourteen ounces; consistence, rather soft; surface scarred deeply and mottled with white infarctions; section shows numerous white infarctions. *Left Kidney:* Weight, six and one-half ounces; capsule, free; consistence, firm; surface smooth, and mottled with minute red spots, which have the appearance of septic infarctions. *Right Kidney:* Weight, six and one-half ounces; condition same as that of left. *Cultures* from the *spleen, liver, and kidneys:* Those from the spleen showed two colonies of the micrococcus lanceolatus. Those from the liver showed a great many colonies of the same. These cocci preserved their characteristics when planted on different media. They were always diplococci of characteristic form and never formed chains, even in bouillon. If not transplanted every two or three days, they quickly died.

Case VII.—Female; book-keeper; aged twenty-two; American; admitted July 10, 1897; discharged August 18, 1897.

Diagnosis.—Endocarditis pneumonica. Result, improved. Complications, retinal hemorrhage.

Family History.—Negative.

Personal History.—The patient had pertussis and "scarlet rash" as a child; there is no history of pulmonary trouble. From the age of eight to fifteen she had very frequent nose-bleeds in summer; her menses have occurred monthly, but have been slightly irregular. For the last year she has been somewhat run down. In May (about the first of the month) she had a severe epistaxis in place of her menstruation and was in bed three days following; she was very pale, but began to work again. About June 1 she had rheumatism in ankles and knees for a week, but was not kept from working; in a few days had a blurring of vision in the left eye and was told she had a hemorrhage in the retina, and the oculist told her she must stop work, which she did. She has had only one slight menstrual flow since May 1. Her bowels have always been regular. There is no alcoholic habit. At the age of ten she had pain in the knees for three days after catching cold. No other history of rheumatism. At the age of fifteen she was told she had a heart-murmur. She has never suffered from dyspnœa.

Present Illness.—On July 2 she fell and strained her left side. Since July 3 she has had pain in the side, between last rib and the crest of the ilium, severe enough to confine her to bed; otherwise she has been

feeling well. Four days ago her physician put her on fluid diet. She has had no diarrhœa, sleeplessness, vomiting, or nose-bleed; her appetite has been good; no cough, no headache, except a slight one yesterday.

Physical Examination.—July 11. *Heart:* Apex impulse is in fifth space, three and one-half inches to left of middle line. There is a systolic thrill felt over apex; action regular, good force. There is a loud and rather harsh systolic murmur heard over the pulmonary area. The area of cardiac dulness is not increased. *Pulse:* Soft, regular, fair quality. *Lungs:* In lower left axillary region there are numerous faint crepitant râles. *Liver:* Normal. *Spleen:* Percusses below the margin of the ribs, but the edge cannot be felt.

July 14. There is a presystolic murmur over mitral area; no longer any pain.

July 15. Spleen felt two fingers' breadth below costal margin; no reaction to Widal's test for typhoid fever.

July 27. *Heart:* Action regular; murmur same as original note; the mitral systolic murmur can be heard over both chests posteriorly. *Lungs:* Left, posteriorly from a point three and one-quarter inches below angle of scapula to base there is marked dulness. In the axillary region there is dulness from a line three inches below nipple to the base. Diminished voice and breathing. *Spleen:* Edge felt one and one-half inches below costal margin.

July 29. Culture from blood taken from the arm contains many colonies; all prove to be cultures of micrococcus lanceolatus.

July 31. General condition very good. Ophthalmoscopic examination shows left retina just above the disk has a small triangular area which is lighter in color than the surrounding part, apparently the remains of an old hemorrhage.

August 1. No petechial spots found.

August 5. *Blood* examined for plasmodium malariæ and none found. Leucocytes, 10,000. No reaction to Widal's test. Patient says that late yesterday afternoon, suddenly, without any pain, things began to look blurred, with a reddish hue, similar to the condition that existed in left eye when that was affected.

August 10. On left forearm and on front of chest are a few small petechial spots.

August 19. By *ophthalmoscope*, right eye: at the macula there is a large red patch about one-half to three-quarters the diameter of the disk, evidently a recent retinal hemorrhage. Left eye: external to macula there is a hemorrhage much like that in the right eye, but much smaller. *Urine*, July 11: Color, amber, clear; specific gravity, 1023; reaction, acid; no sugar; albumin, a trace; leucocytes in fair number; a great many vesical and vaginal cells. *Temperature* has been rather irregular, but not rising higher than 101° to 102°.

The patient now was discharged from the hospital at her own request.

The history of her condition after she left the hospital, as obtained from her friends, is as follows:

She improved somewhat at first. About three weeks after leaving the hospital she had another attack of blindness in the same eye that was first affected. Soon after this she had several attacks of sudden sharp pain in the region of the spleen. She then gradually grew weaker. In the early part of November she had a sudden attack of hemiplegia, involving the left side of the face, and left arm and leg. She remained in this condition for about twelve hours and then became unconscious, and died a few hours later.

Case VIII.—German; aged forty-four years; housewife; admitted January 18, 1902; died January 28, 1902.

Pathological Diagnosis.—Chronic endocarditis, septicæmia, infarcts of lung and spleen, nephritis, suppuration of ethmoidal and sphenoidal sinuses, purulent cerebro-spinal meningitis.

Family History.—Negative as to tuberculosis, neoplasm, and rheumatism.

Previous History.—As a young girl, had typhoid fever. Menstrual history normal. Drinks very moderately. Eight years ago she had a severe attack of grippe and since that time her eyesight has been somewhat impaired.

Present illness began eleven days ago with severe headache; this has continued, and with such severity as to force her to keep to her bed. The pain is most marked on the left side, and especially at night; cold applications relieve it somewhat. Three days before admission she had a shaking chill followed by fever and sweating; pain in head increased and she was much prostrated. There has been no cough, no epistaxis, no diarrhœa.

Physical Examination.—January 19. Left eye is markedly inflamed, conjunctivæ swollen and red and œdematous, as are both eyelids. Pupils react and are equal and there is no irregularity. *Heart:* Apex impulse is in seventh space, three and one-fourth inches to left of median line; left limit of dulness in fifth space is four inches to left. Action is regular, of good force; at apex there is a blowing, systolic murmur transmitted into the axilla; both second sounds at the base are accentuated. *Pulse* is regular, of good force; no increase in tension, no thickening. *Lungs:* Numerous subcrepitant râles at both bases, and at left base posteriorly; expiration has rather a bronchial whiff. *Liver:* Apparently normal. *Spleen* does not percuss large; edge not felt. *Abdomen* is soft, prominent. In right flank there is a large rounded mass indefinitely felt, which is tender to pressure, probably kidney. *Extremities:* Normal.

On Admission, pulse, 104; respiration, 34; temperature, 104°. *Blood:* Leucocytes, 21,000 per c.cm.

January 20. Temperature, 104°; eye is more swollen; pupils are rather contracted, but react well to light and accommodation. Neck is very rigid. *Heart* and *lungs* as before. Kernig's sign is not present. *Blood:* Leucocytes, 19,000 per c.cm.; Widal reaction negative. *Urine:* Amber, clear; specific gravity, 1022; alkalinous; sugar, none; albumin, two per cent. by volume. *Microscopical Examination:* Epithelium; no casts.

January 21. Patient had a chill last night with a rise of temperature to 105°. *Heart* and *lungs* as before. There is more retraction and rigidity of the neck. Neither Kernig's nor Babinski's signs are present. *Blood-culture* shows growth of diplococci which look like pneumococci.

January 22. *Lungs:* Posteriorly below and internal to right scapula is an area the size of a man's hand which is dull on percussion, and over which there is bronchial voice and breathing; no râles. *Blood:* Differential count: Polymorphonuclear, 865; large mononuclear, 8; small mononuclear, 5; eosinophiles, 0.5; red cells show pallor of centres.

January 25. *Blood-culture:* One tube shows mixture of pneumococci and larger cocci, probably staphylococcus pyogenes aureus; one shows cocci resembling pneumococci. Culture from eyes show staphylococci; culture from nose shows pneumococci.

January 27. For past forty-eight hours condition has been rapidly

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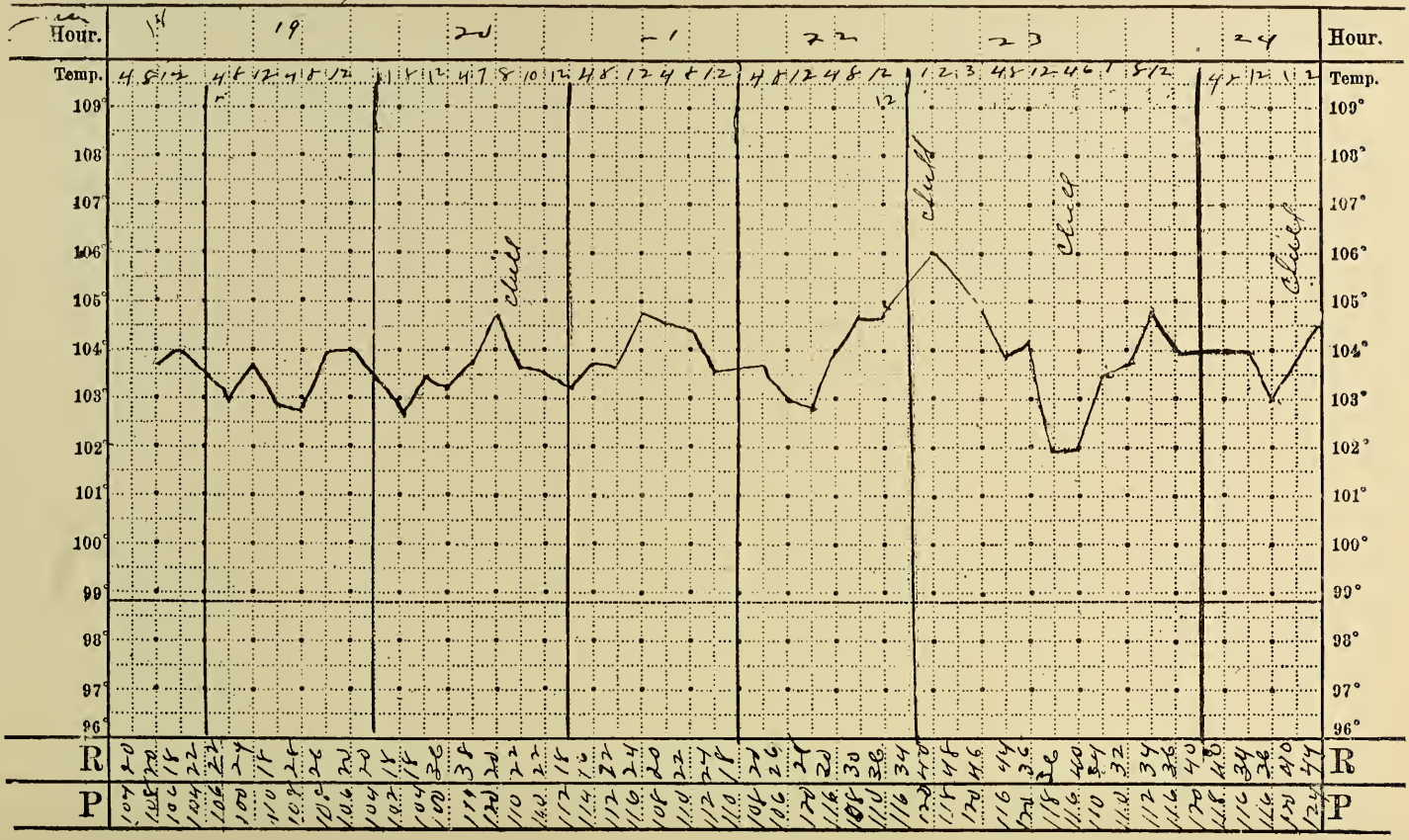

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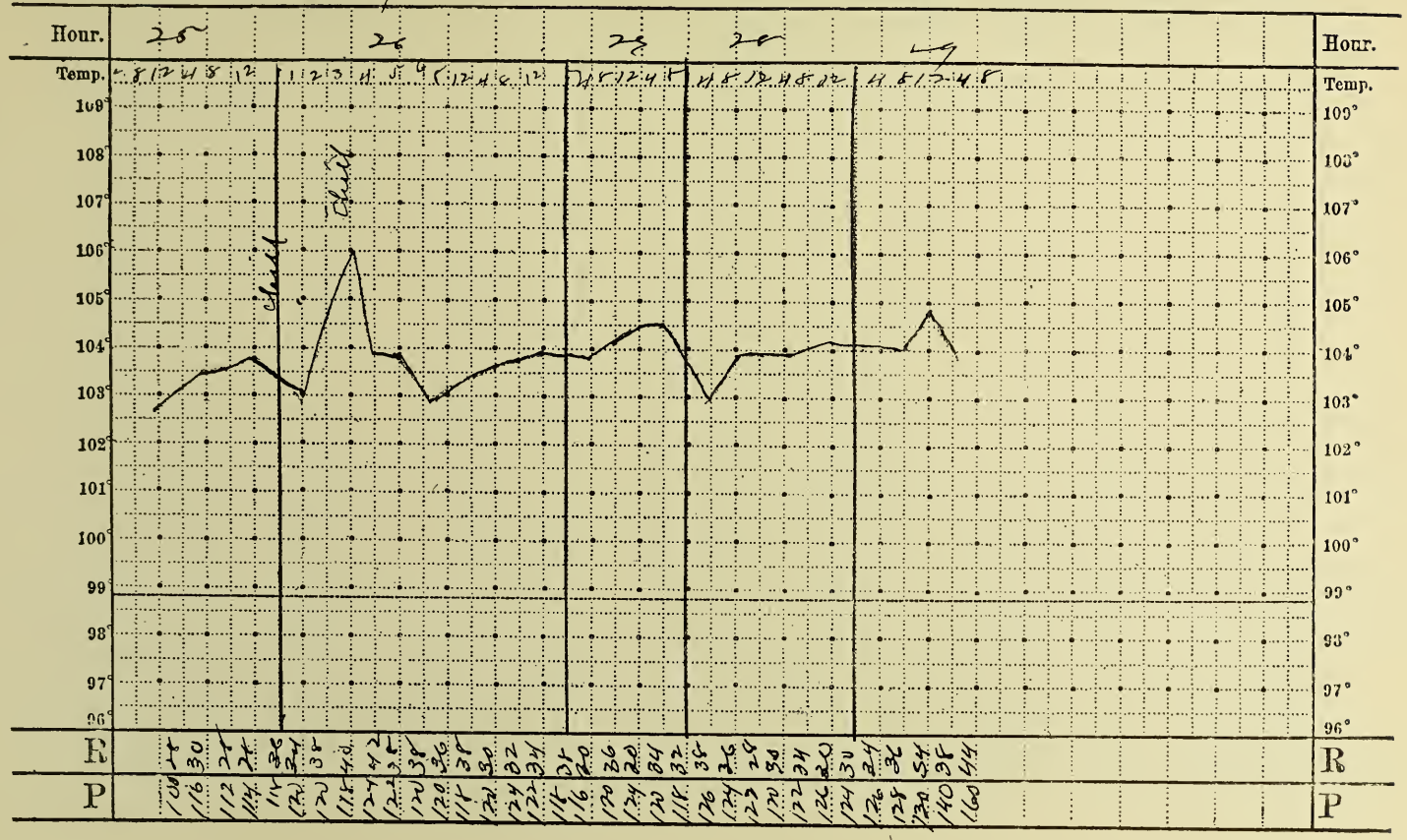

growing worse. Neck very rigid. Kernig's sign is present. Fluid from lumbar puncture: 23 c.c. of very slightly cloudy fluid, with slight white stringy sediment. *Microscopical Examination:* Some polynuclear leucocytes and lymphocytes; a little fibrin, a considerable number of cocci; these are almost entirely arranged in pairs or short chains; many have a lance shape. They are extracellular and are probably pneumococci, but positive diagnosis can only be made from cultures. *Urine:* Amber, cloudy; specific gravity, 1020; acid; sugar, none; albumin, four per cent. by volume. *Microscopical Examination:* Pus and epithelial cells; numerous hyaline and granular casts. *Temperature* has been continuously high—104° to 105°—with frequent chills. *Died* January 28.

Autopsy.—Heart: Pericardium, normal. Valves: Mitral shows polypoid mass of vegetations, also a number of minute vegetations scattered on its surface. *Lungs:* A number of minute nodules containing pus in right. *Spleen:* A number of infarctions, becoming gray. *Brain:* There is a layer of pus at base, and the tissues around are stained blackish; ventricles contain turbid serum; right lateral sinus contains a clot, also right cavernous sinus. Bones at the base of skull are eroded and sphenoidal and ethmoidal sinuses are filled with pus. Cord as far down as cauda is bathed in creamy pus.

Group III.

The following two cases are of streptococcus origin.

Case IX.—Aged twelve; female; admitted November 28; died December 3, 1902.

Family History.—Negative as to rheumatism, chorea, and tuberculosis.

Previous History.—Child has never been strong, although never ill; she is under-sized; never had scarlet fever, diphtheria, or chorea. She has shortness of breath on exertion, and is subject to nose-bleeds.

Present illness began about four and one-half weeks ago, sudden in onset, and confining child to bed almost constantly. She has had an irregular fever, varying greatly at different times; sometimes high, at others apparently none; indefinite chills with sweating. She has vomited several times, and for last few days the bowels have been loose.

She has been much inconvenienced by flatulence, and has had a good deal of headache. Nose-bleeds have been frequent during the present illness. During the past few days the patient has been getting worse, temperature is higher, prostration is greater, and weakness is more marked. There is pain in extremities and back, but not located in the joints.

Physical Examination.—November 28. *Heart:* Impulse is heaving over entire lower precordium. Maximum impulse is in fifth space, three inches from middle line, almost in anterior axillary line; dulness extends one-half inch farther to left; action is rapid, regular and of good force. At apex is a loud blowing systolic murmur transmitted to axilla and back, and heard over entire left chest. Pulmonic second sound is loud. *Pulse* is regular, rapid, small, of poor force; no increase in tension, no thickening. *Lungs:* Normal. *Liver:* Apparently normal. *Spleen:* Percusses large; edge distinctly felt well below costal arch and is distinctly tender. *Surface:* No eruption.

On Admission, pulse, 160; respiration, 32; temperature, 103°.

November 29. *Urine:* Normal. *Blood:* Leucocytes, 12,800 per c.cm.; red blood-cells, 3,592,000 per c.cm.; hemoglobin, fifty per cent.; index, 0.63 per cent. No malarial organisms found.

December 1. *Leucocytes:* 14,800 per c.cm. *Sputum:* No tubercle bacilli found.

December 2. To-day child became semi-comatose and developed a right hemiplegia; there were some convulsive movements of left side of face also; pulse, poor, feeble. *Blood-culture* shows streptococcus pyogenes. *Temperature* has been irregular, from 100° to 105°. *Died* December 3. No autopsy could be obtained.

Case X.—Aged twenty-four; housewife; admitted August 12, 1897; died August 18, 1897.

Pathological Diagnosis.—Malignant endocarditis; infarcts of spleen and kidneys; cerebral hemorrhage; infarcts of heart-muscle; adhesive peritonitis, splenic.

Family History is good as far as is known.

Previous History.—Moderate alcoholic habit. Two children; no miscarriages; menses regular. No previous illness ever.

Present Illness.—Nine days before admission patient began to menstruate. She ate a considerable quantity of indigestible food and

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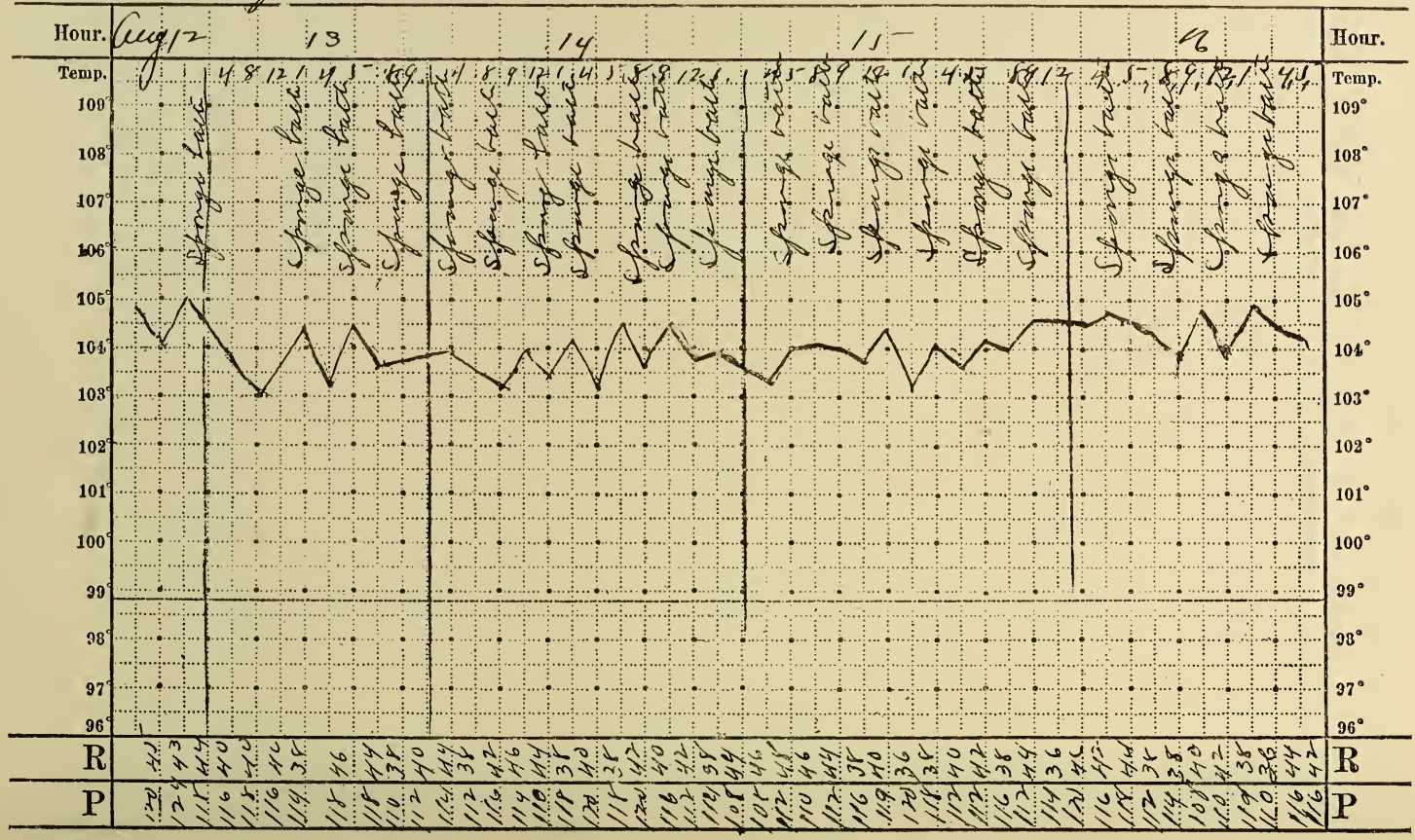

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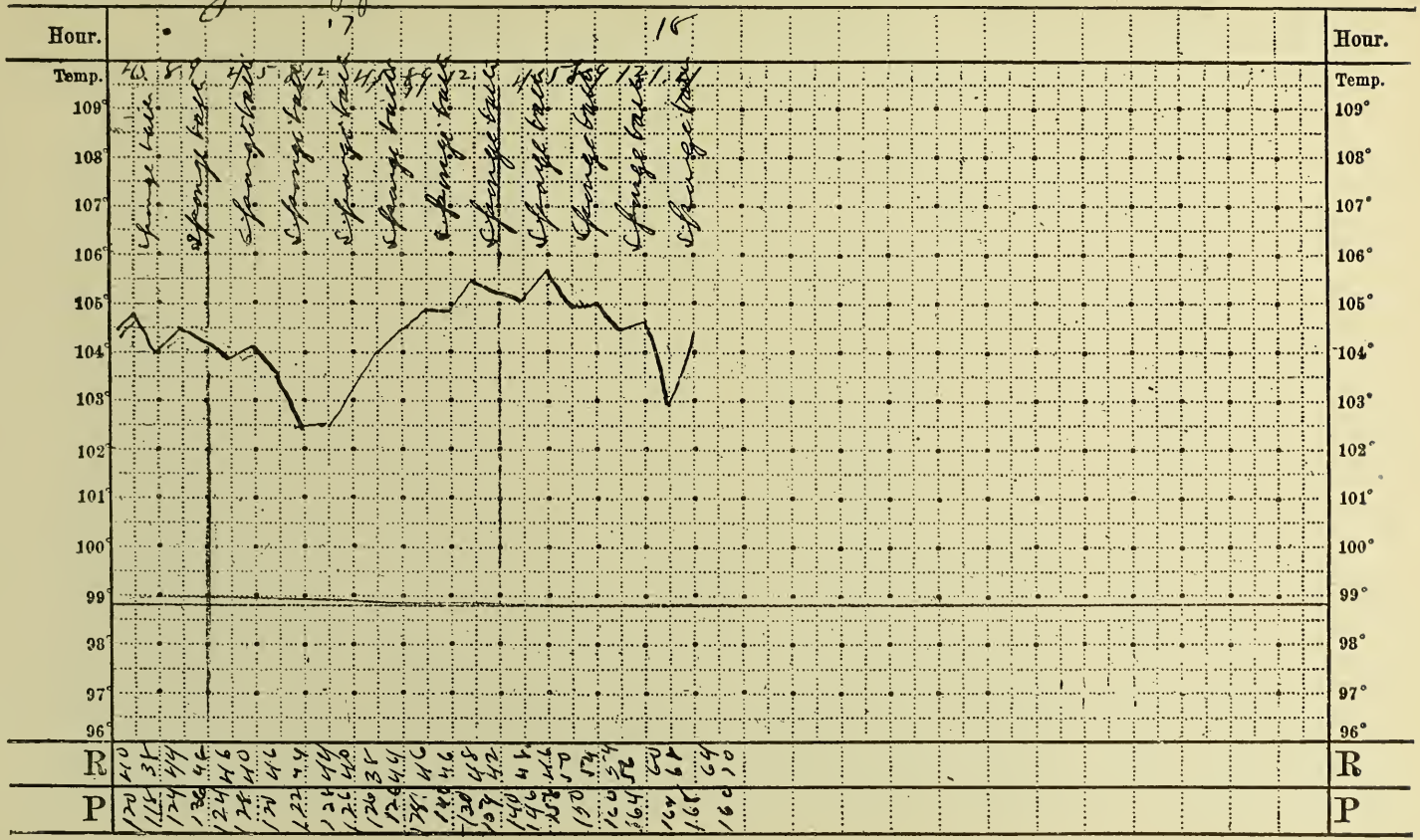

drank some beer; she caught cold, and on the following day had pain in abdomen and left side; vomited a number of times and was troubled with diarrhœa. Diarrhœa lasted four days and then subsided. She has vomited every day, and once the vomitus contained a little blood. She has had several chills each day. Cough has been present with pain in left side, but no expectoration. Headache has been persistent.

Physical Examination.—August 12. *Heart:* Apex is in fifth space, four and one-half inches to left of midsternal line; action is regular and of good force. There is a soft, systolic murmur at apex transmitted to left, and some accentuation of pulmonic second sound. *Pulse* is regular, full; no increase of tension, no thickening. *Lungs:* Normal. *Liver:* Normal. *Spleen:* Percusses a little large; edge is not felt.

On Admission, pulse, 120; respiration, 45; temperature, 105° F. *Urine:* Amber; specific gravity, 1020; acid; sugar, none; albumin, a trace. *Microscopical Examination:* A few hyaline casts.

August 14. *Blood:* No reaction to Widal test. Leucocytes, 17,000 per c.cm.

August 16. Heart-murmur is fairly harsh and can be heard over both chests posteriorly.

August 19. *Surface:* There are a few petechial spots on right forearm and above right clavicle. Patient is sinking and is now in coma. *Temperature* has been typhoid in character—104° to 105°. *Blood:* There is no reaction to Widal test. Leucocytes, 17,000 per c.cm. *Cultures* from blood show streptococcus pyogenes. *Died*, August 18

Autopsy.—Heart: Weight, ten ounces. Pericardium normal. Valves: Aortic show minute vegetations on all cusps. Mitral has a considerable mass of fibrin on both flaps, one cusp being perforated and eroded. Muscle is flabby and pale and shows a number of small septic infarcts. Arteries are thick. *Lungs:* Congested and œdema of lower left; right the same. *Liver:* Normal. *Spleen* is very soft, adherent to surrounding parts; a number of infarctions are scattered throughout; one a large one, being broken down and filled with bloody pus. *Kidney:* Left, surface mottled with infarctions. On section there are many wedge-shaped infarcts. *Brain:* Medulla and pons are surrounded by extravasated blood; in right occipital lobe is a blood-clot the size of an egg, around which the brain substance is much softened.

Group IV.

A collection of cases not showing organisms, but the autopsies or clinical signs of which confirm the diagnosis.

Case XI.—Aged thirty-one years; housewife; admitted August 2; died September 22, 1900.

Family History.—Negative.

Previous History.—Patient does not remember about childhood's diseases. At thirteen years of age had chills and fever, tertian type. Not alcoholic. Six months ago she had a slight attack of rheumatism involving her ankle-joints.

Present Illness began seven weeks ago, with pain and swelling in hands and feet accompanied by fever and anorexia, and for five weeks patient was in bed; during the past two weeks she has been up and about the house, but the pain has persisted. She has had no shortness of breath, no palpitation, no attacks of faintness. She is subject to morning headaches sometimes. Urine is rather small in amount. Bowels are regular. There is no vomiting, no jaundice.

Physical Examination.—August 3. *Heart:* Maximum; impulse is in fourth space, three and three-quarters inches to left of median line; action is regular, a little rapid; at the apex there is heard a systolic and diastolic murmur, the former transmitted into the axilla; systolic and diastolic murmurs also heard over the third left interspace and transmitted down the border of the sternum. *Pulse* is regular, soft, full; not typical Corrigan in character. *Lungs:* Normal. *Liver:* Normal. *Spleen* not made out. *Extremities:* There is pain and tenderness over dorsum of left foot, also in joints of left hand. There is also pain over left arm as high as the shoulder.

August 4. Patient had a sharp chill this A.M., followed by rise of temperature to 104°. *Spleen* not made out. *Urine* is normal. *Blood:* No malarial organisms found. Leucocytes, 10,000 per c.cm.

August 14. Patient has been running a very irregular temperature, ranging from 98.8° to 104°; she perspires profusely. *Heart* murmurs are heard more distinctly; there are twenty petechiæ. Pulse is more Corrigan in character. *Blood-culture:* No growth in two different trials. No malarial organisms found. Leucocytes, 10,000 per c.cm.

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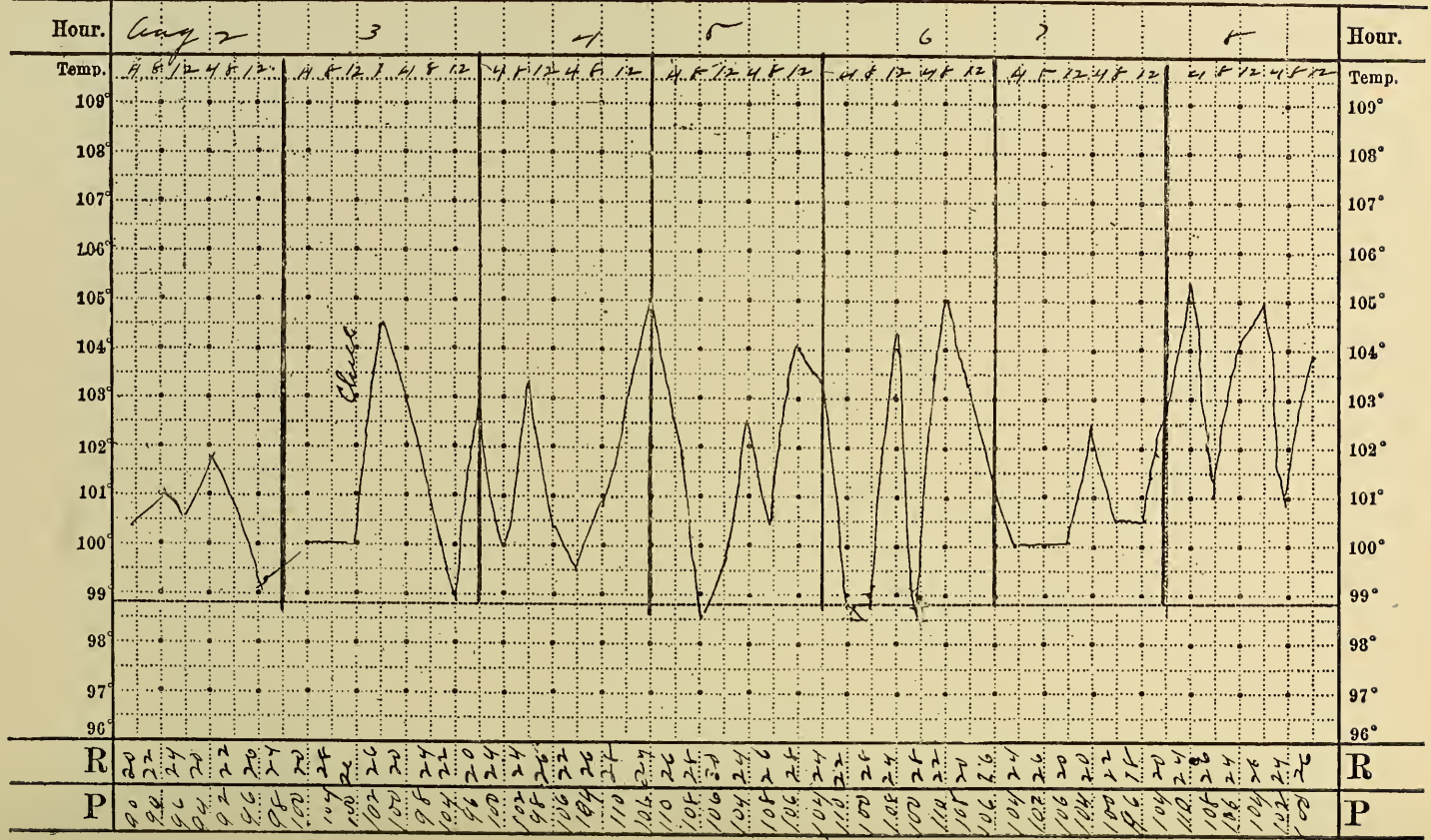

August 30. Patient has had a chill every day, with a rise of temperature to 106°, accompanied by profuse sweating. She is delirious part of the time; no petechiæ have appeared.

September 15. Chills continue every day, temperature ranging from 99° to 106° F. almost daily. *Heart:* There is a distinct systolic murmur heard over the entire precordium. Anæmia is profound; no petechial spots present; patient is *in extremis*. *Urine* contains a trace of albumin and a few hyaline casts. *Blood:* Hemoglobin, forty-five per cent. Leucocytes 16,000 per c.cm. *Blood-culture:* No growth on four different trials.

Autopsy.—Heart: Weight, eleven and one-half ounces. Pericardium contains a little turbid serum. Valves: Aortic has one cusp greatly hypertrophied like a polypoid mass of granulation tissue; surface a little rough, but no ulcerations. Muscle is pale and looks fatty. *Lungs:* Congested. *Liver:* Fatty. *Spleen* shows a few small infarcts. *Kidney* shows moderate interstitial nephritis. *Cultures* from the spleen give no growth.

Case XII.—Aged forty-two; admitted November 4, 1897; died November 13, 1897.

Diagnosis.—Chronic endocarditis, atheroma of coronary arteries, thrombi in left ventricle, embolism of superior mesenteric and both common iliac arteries, infarcts of lung, necrosis of ileum, acute peritonitis, chronic nephritis.

Family History.—Several members of the family have had endocarditis, and an uncle had pulmonary tuberculosis.

Previous History.—There is no alcoholic, specific, rheumatic, or malarial history. For years patient has had slight dyspnœa on exertion. About eight or ten years ago feet swelled for a time, and face was also puffy, but these symptoms soon disappeared; has frequent headaches; there has been no diminution of urine. About ten months ago the patient had an attack of severe dyspnœa accompanied by profuse sweating and lasting about two hours. Two weeks later this attack recurred. She has frequent attacks of cardiac palpitation.

Present Illness.—Seven days ago the patient had a third attack similar to the two previous ones, and the symptoms have persisted to the present time. Two days ago the breathing was very difficult, and at all times dyspnœa is marked. She complains also of sore throat.

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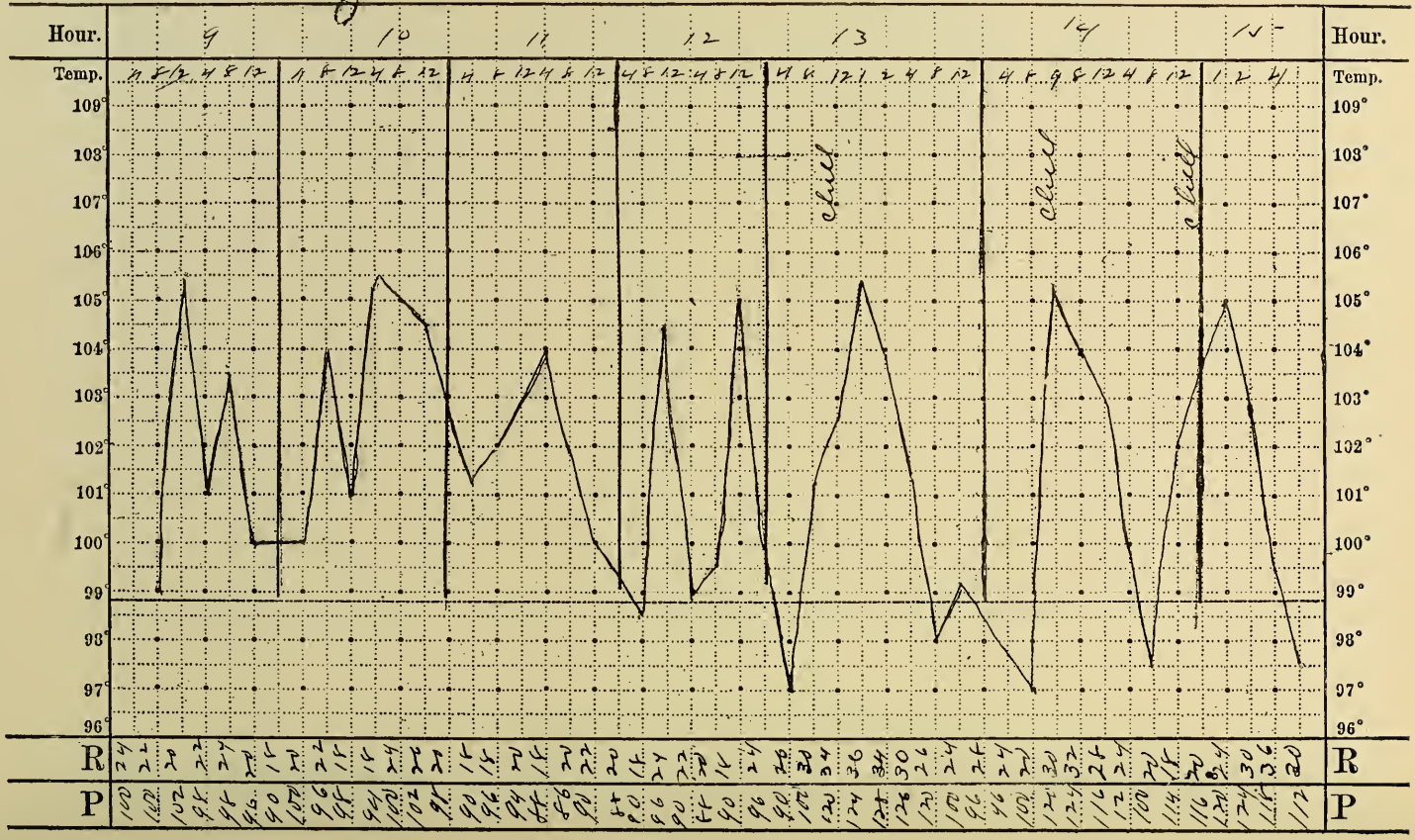

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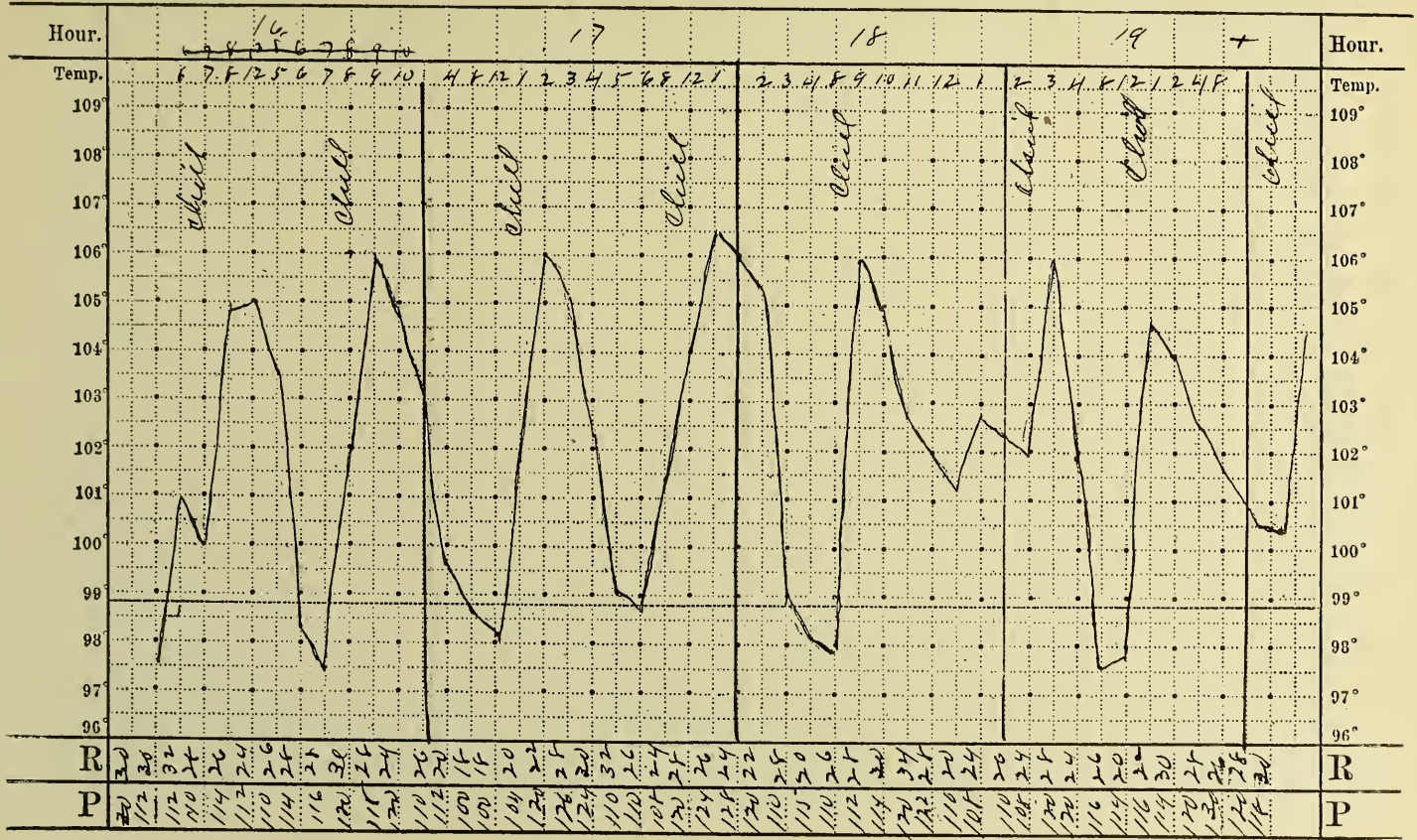
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Physical Examination.—November 5. There is slight puffiness of the lower lids. Dyspnœa is a marked feature, and the patient is not able to lie down. *Heart:* Apex is in sixth space, five inches to left of median line; limit of cardiac dulness corresponds. At the apex is heard a presystolic rumble and a systolic murmur, the latter harsher in character and transmitted into the axilla. There is slight accentuation of the pulmonic second sound. *Pulse:* Left rapid, full, with some increase in tension and some thickening. Right is very small and is not synchronous with the apex beats, as it frequently intermits. *Lungs* show evidence of consolidation over right upper lobe, and a little fluid at both bases behind. *Liver:* Edge not made out; palpation is painful. *Spleen:* Percusses large; edge not felt.

On Admission, pulse, 128; respiration, 28; temperature, 98.4°. *Urine* shows a trace of albumin and a few hyaline and granular casts.

November 8. Murmurs are very faint; rhythm is galloping. Flatness at right base extends within two finger-breadths from angle of scapula; voice rather bronchial in character. General condition is not so good. Hemoglobin, seventy-three per cent.

November 11. Left leg: From patella down, leg is very pale, cold, and no pulsation can be felt in the arteries; leg feels numb.

November 12. Patient is delirious; considerable jactitation, becoming almost choreiform. Right leg from knee down is discolored in places; lower one-third of leg and foot are cold and devoid of sensation, and no pulsation can be felt in posterior tibial or dorsalis pedis vessels. *Blood-culture* incubated from November 11 to November 19 shows no growth. *Urine:* Albumin is twenty-five per cent. by volume. Microscopical Examination: Shows many granular and hyaline casts. *Leucocytes*, 27,000. *Temperature* has been running from 100° to 102° F.; the last few days, however, it has been 104°; pulse, 120. *Died* November 13.

Autopsy.—Heart: Aortic and mitral valves a little thickened but smooth, slightly contracted; some atheroma of aorta; other valves normal. Muscle: There is some thickening of the wall of the left ventricle at lower portion and an appearance of slight fibrous change there. *Arteries* show extensive atheroma of the coronaries. *Lungs:* Hemorrhagic infarctions in both. *Kidney:* Right shows chronic inflammation. *Intestine:* Lowest two feet of ileum appear necrotic,

partly red, partly white, or pale yellow, covered with abundant inflammatory exudation. The tissue here was easily broken by a stream of water introduced to wash it out. The branches of the superior mesenteric artery supplying this part of the intestines were plugged by firm thrombi. *Bladder* contained bloody fluid. *Arteries:* Thrombi gray or firm, or both, are found in both common iliac arteries—internal iliac, the right femoral and popliteal. *Cultures* on blood-serum from spleen, kidney, and heart are all sterile.

Case XIII.—Aged forty-four; machinist; admitted July 27; died September 8, 1902.

Diagnosis.—Acute endocarditis, septicæmia, pelvic abscess, infarctions of both kidneys, gall-stones, fat necrosis of pancreas, nephritis.

Family History.—Negative concerning endocarditis.

Previous History.—Measles, scarlet fever, diphtheria as a child. No sequelæ apparently. Has always been a steady and considerable whiskey-drinker. Gonorrhœa twenty years ago, no complications; denies syphilis. Malaria twenty years ago. About one year ago patient had symptoms of nephritis.

Present Illness.—About ten days before admission, patient strained his back while lifting a heavy weight, and shortly afterward passed reddish urine; the following day his back was very sore and stiff, so that he stopped work. Feet did not swell, he had no dizziness, nor headache, and no gastric symptoms. There has been no fever and no cough. He has been in bed for over a week, due to the pain and stiffness in his back, which bothers him only upon motion. The reddish tinge of the urine has persisted, but he has passed no pure blood nor clots. There has been no nausea nor vomiting, no abdominal pain, and appetite is still good; he is rather constipated.

Physical Examination.—July 28. *Heart:* Apex impulse is neither visible nor palpable. Sounds are just audible in fifth space, four and a half inches to left of median line; action is regular, of fair force. A very faint blowing systolic murmur is heard at the apex—not transmitted. *Pulse* is regular, of good force; slight thickening and tension of the arteries. *Lungs:* Anteriorly normal; posteriorly at bases are heard pleuritic friction-rubs. *Liver* is apparently normal. *Spleen:* Not made out. *Extremities:* Lower: Reflexes are very active. Ankle clonus is prominent on both sides. Blow on heel gives pain in lumbar region.

Surface: Over lower lumbar region there is a small area on deep palpation over spinous processes which is tender. No mass to be made out.

On Admission, pulse 102; respiration, 29; temperature, 101°. *Leucocytes*, 8,300 per c.cm.

July 29. Urine shows a trace of albumin and a few granular casts.

August 11. Temperature rose last night to 105.3°. Patient has been very drowsy of late. *Blood:* Leucocytes, 11,200 per c.cm.; red cells, 4,596,000 per c.cm.; Widal reaction negative; no malarial parasites found.

August 16. *Leucocytes*, 12,400 per c.cm.; red blood-cells, 4,500 per c.cm.; hemoglobin, ninety per cent. Differential count: Polymorphonuclear, eighty-six per cent; lymphocytes, 8.3 per cent.; large mononuclear, five per cent.; eosinophiles, 0.5 per cent.; mast cells, none. *Urine* examination as before—a trace of albumin with a few casts.

August 23. Temperature is rising every day; small petechiæ have been appearing for the past three days. Urine and fæces have been passed involuntarily during the past few days. *Heart:* A very soft double murmur is heard at apex. Apex is now visible in fourth space four inches to left of median line. *Blood-culture:* Three tubes of blood serum, three of bouillon taken; one tube contaminated, the others are sterile.

August 26. *Heart:* Double murmur is more distinct. *Blood:* hemoglobin, eighty-five per cent. Leucocytes, 15,500 per c.cm.; Widal reaction negative.

August 31. Patient continues irrational; petechial spots on surface have nearly all faded. *Heart:* As before. *Lungs* show subcrepitant râles at bases.

September 5. Petechiæ have disappeared; delirium continues. *Urine:* As before; indican, heavy trace. *Temperature* has been fairly regular, rising gradually to 106°. There have been no chills. *Died* September 8.

Autopsy.—Heart: Weight, thirteen ounces. Fibrous patch on pericardium. Valves: Aortic shows large, irregular, rather soft, gray vegetations; some firm thickening on edges of the cusps, and considerable adhesions to cusps. Muscle: Left ventricle is a little hypertrophied, rather pale; coronary arteries appear normal. *Lungs:* Left shows moderate emphysema; right, many old adhesions. *Gall-*

bladder: Distended with a great number of small, smooth calculi. *Liver* shows evidence of congestion. *Spleen:* Very soft; surface normal; looks dark. *Pancreas* is very firm; shows many small areas of fat necrosis at periphery, also in surrounding tissues. *Kidneys:* Left capsule free; slightly pale, with some congested vessels; at one end is a large white infarction two inches in diameter; cortical markings are exaggerated. Right the same, but showing a smaller infarct.

Case XIV.—Aged twenty-five; plumber; admitted August 31; died September 24, 1903.

Family History.—Negative as to tuberculosis and neoplasm. Mother had rheumatism.

Personal History.—Does not know of childhood's diseases. Slight alcoholic history. Six months ago had gonorrhœa and was treated by internal medication for six weeks; there is no discharge at the present time. Denies syphilis; never had rheumatism. Six years ago had chills and fever, attacks occurring every two or three days. This passed off and has never recurred till six weeks ago.

Present Illness began six weeks ago with a shaking chill followed by fever and sweating; the attacks would last about one hour and recur after two days; he was treated for malaria. For a week past he has had cough, but no expectoration; has vomited two or three times; chills and fever continue, with occasional sweats. The paroxysms occur every day, usually in A.M., and last one-half hour. Has lost twenty pounds. Has not taken quinine for three days.

Physical Examination.—September 1. *Heart:* There is considerable heaving over the precordium; impulse is diffuse; left limit of dulness is in fifth space, four inches to left of median line. Right heart apparently not enlarged; action regular, rapid. At apex is heard a soft systolic murmur of considerable intensity transmitted into axilla, and also to the right as far as the sternum. Pulmonic second sound is accentuated. *Pulse* is regular, rapid, dicrotic, of fair force; vessel wall is thickened. *Lungs:* Normal. *Liver:* extends from the fifth rib to free margin of the ribs, edge not felt. *Spleen:* Percusses large; edge felt just below costal margin.

On Admission, pulse, 80; respiration, 18; temperature, 98.8°. *Blood:* Widal test negative. No malarial organisms found. Leucocytes, 17,400 per c.cm. *Urine:* Normal.

September 2. *Temperature* has been running irregularly between 99° and 104°. Patient has had but one chill and feels better. *Blood:* No malarial organisms. Leucocytes, 14,800 per c.cm. Differential: Polymorphonuclear, ninety per cent.; lymphocytes, 5.5 per cent.; large mononuclear, 4.5 per cent.; eosinophiles, absent; mast cells, absent. *Blood-culture:* Microscopical Examination: Cocci which do not correspond with any pathogenic variety probably due to contamination.

September 18. Temperature continues irregular. Last night patient coughed up three ounces of pure bright blood. *Lungs:* Anteriorly, normal: posteriorly, left—percussion is normal, but in lower interscapular region is an area of intense bronchial voice and breathing; no râles are present, and fremitus is diminished; right—faint distant bronchial breathing and voice, close to vertebral column in lower interscapular region. *Heart:* Apical murmur is harsher. A systolic murmur is also heard over both valves at the base. *Blood:* Leucocytes, 16,000; hemoglobin, fifty per cent. *Urine:* As before, but contains few hyaline casts and a little pus.

No autopsy could be obtained.

Case XV.—Aged twenty-nine; housewife; admitted December 2; died December 20.

Diagnosis.—Malignant endocarditis, chronic congestion of the viscera, dilatation of heart, hydropericardium, hydroperitoneum, infarction of lung, Meckle's diverticulum.

Family History.—Mother had heart disease; otherwise negative.

Previous History.—Measles and scarlet fever as a child. Never had rheumatism. At sixteen years of age she began having attacks of palpitation of heart and cardiac pain. A physician at that time told her she had heart trouble; since that time she has always been short of breath and had violent palpitation on the slightest exertion. There has never been any œdema of extremities.

Present Illness.—Three days before admission she had a chill, followed by fever. The following day, also the next after that, the chill and fever were repeated. She had no regular malarial paroxysms; has had no headache; no nausea nor vomiting. Bowels habitually constipated.

Physical Examination.—Heart: Maximum impulse is in fifth space, four and a half inches to the left of the median line. Impulse is visible

and is diffuse; there is pulsation of vessels of the neck; at apex a presystolic thrill can be felt; a marked pulsation can be felt in epigastrium. There is a presystolic murmur at apex, transmitted into the axilla. A systolic murmur is heard over the precordium, which can also be heard in the left interscapular region. There is a rough systolic murmur over pulmonary area with marked accentuation of pulmonic second sound. *Pulse* is regular, soft; no thickening. *Lungs:* Normal. *Liver:* Percusses from seventh rib to free margin; edge indefinitely felt. *Spleen:* Percusses large; edge felt one inch below costal margin.

On Admission, pulse, 106; respiration, 28; temperature, 101.6°.

December 2. *Urine:* Acid; 1033; no sugar; albumin, faint trace. Microscopical Examination: Few small granular and hyaline casts. *Blood:* No malarial organisms found; no Widal reaction; no growth on culture.

December 6. *Blood:* Hemoglobin, fifty-nine per cent; red cells, 3,700,000 per c.cm.; leucocytes, 23,000 per c.cm.; polymorphonuclear, 91.6 per cent.; large lymphocytes, 3.2 per cent.; small lymphocytes, 4.2 per cent.; myelocytes, one per cent.

December 17. *Leucocytes*, 25,000 per c.cm.; no Widal reaction. *Cultures from Blood:* No growth.

December 19. *Heart's* action is more rapid and tumultuous, galloping rhythm. There are many minute petechial spots over the abdomen, so general as to give a purple hue to the skin.

December 20. Breathing over whole right chest is diminished. *Blood:* Leucocytes, 12,500. *Temperature* has been running pretty continuously at 103°. *Died* December 20.

Autopsy.—Heart: Pericardium contains 100 c.cm. of clear fluid. Right auricle is much distended and there are numerous tubercular nodules of fibrous tissue scattered over it. Right ventricle is much hypertrophied and dilated; walls are somewhat thickened, and endocardium is greatly thickened and fibrous. In the auricular appendage are several nodules of fibrin which have become softened in their interior valves; the tricuspid is thickened, retracted with a fringe of minute vegetations along the edge. The mitral will not admit the tip of the little finger. The cusps are greatly thickened and have grown together, and upon the auricular surface are two spots of softened vegetation. The aortic valve admits the little finger with some difficulty. One of

the cusps is fairly complete, somewhat thickened, one is undermined and perforated by an ulcerating cavity, and the remnants of it are greatly thickened, so as to form a polypoid mass. *Lungs:* Left: One hemorrhagic infarct in the lower lobe; tissue of lung firm, very tough. Section: Of a rather light reddish color, somewhat œdematous, shows changes of brown induration. Right the same. *Liver:* Moderate nutmeg. Other viscera normal.

Case XVI.—Aged forty-one; whitewasher; admitted March 14, 1895; died March 24, 1895.

Pathological Diagnosis.—Malignant endocarditis, infarctions of heart-muscle, abscess of liver, infarctions of spleen, chronic nephritis, cardiac hypertrophy and dilatation.

Family History.—Negative.

Previous History.—Gonorrhœa twenty years ago; rheumatism eight years ago. Six months ago the patient caught cold and had retention of urine for a day; this was followed by fever and chill, and sweating every other day for two weeks.

Present Illness.—Since that time he has not felt well; no appetite; cough, fever, and constipation. For three weeks has had œdema of feet, and for a week abdomen has been swollen.

Physical Examination.—Heart: Dulness increased to left; a loud systolic murmur is heard at apex, transmitted into axilla and heard in the back. *Lungs* give rise to scattered subcrepitant râles. *Liver* is indefinitely felt. Other viscera normal as far as can be ascertained.

On Admission, pulse, 100; respiration, 26; temperature, 98.4°. *Urine:* Normal; soon became involuntary, patient becoming delirious. Edge of liver felt two and one-half inches below costal arch. *Temperature:* High, remittent, accompanied by chills, ranging daily from 100° to 106° F. *Died* March 24.

Autopsy.—Heart: Weight, fifteen ounces. Pericardium: Normal. Valves: Mitral shows enormous fibrinous vegetations; above is an area of roughening of auricular surface. Muscle is flabby; all cavities dilated; near apex of left ventricle is a white infarction of the muscle, and the coronary artery leading to it contains a thrombus. *Liver* is pale and nutmeg. There is an abscess three-quarters of an inch in diameter in right lobe. *Spleen* contains two white infarctions, one

partly broken down; pulp is soft. *Kidney:* Capsule is adherent; surface pale, smooth, and shows a small infarction. Section: Cortex pale yellow; markings are indistinct.

Case XVII.—Aged twenty-six; fireman; admitted November 7, 1894; died January 8, 1895.

Pathological Diagnosis.—Malignant endocarditis, infarcts of spleen and kidney, cardiac hypertrophy and dilatation.

Family History.—Negative.

Previous History.—Four years ago was in a hospital with heart trouble; no malarial or syphilitic history; moderately alcoholic. Two years ago had an attack of rheumatism, lasting ten months. Has had two attacks of gonorrhœa. Three months ago had to stop work because of dyspnœa and a heavy pain across chest. He has had night-sweats, cough, hoarseness; morning vomiting; no temperature, no chills.

Physical Examination.—The patient is pale, emaciated; dyspnœa is evident. *Heart:* Apex impulse in fifth space, five and a half inches from median line; left limit of dulness corresponds; impulse is diffuse and forcible; no thrill is made out. There is a systolic murmur at apex, transmitted into the axilla; a systolic and a diastolic murmur at the base, the systolic being heard over entire chest, the diastolic transmitted down the sternum. *Pulse:* Corrigan. *Lungs:* Few subcrepitant râles heard at right base behind. Other viscera apparently normal.

On Admission, pulse, 99; respiration, 24; temperature, 98°. *Urine* is normal.

On November 9th a profuse purpuric eruption appeared; the breathing is often very labored and the color poor. Numerous tubercle bacilli found in the sputum. Cardiac symptoms the same. At right apex is slight dulness with sibilant râles. *Temperature,* although not going above 102° F., was irregular; after three weeks it was normal and remained so for three weeks longer, or until just before death. There were no chills and no marked symptoms of a severe septic infection. *Died* January 28.

Autopsy.—Heart: Weight, 28 ounces. Pericardium is adherent over an area of two and a half inches anteriorly. Valves: Aortic cusps are eroded, covered with vegetations, some of which are calcareous; one small aneurismal sac one-half inch in diameter lying between left auricle and the aorta opening just beneath one of the cusps of the

valve; the vegetations extend down into the ventricle, also on the endocardium and the under surface of the mitral valve. Mitral is thickened, retracted, and has a few vegetations on its edge. Muscle is hypertrophied and the cavities are dilated, the left ventricle greatly. *Pleura:* Adherent. *Spleen:* Soft, smooth; there are several infarctions, red and white.

Case XVIII.—Aged twenty-six; vendor; admitted March 21, 1895; died March 24, 1895.

Pathological Diagnosis.—Malignant endocarditis, renal infarction, cerebral embolism and softening, hypertrophy of spleen.

Previous History.—Rheumatism three years ago; chancre eight years ago, followed by secondary symptoms. Moderate alcoholic habit; no malarial history.

Present History.—Was well until eight days ago, when severe headache began and has been persistent; chills, fever, and sweating occurred at irregular intervals; occasional vomiting and diarrhœa; no epistaxis. Three days ago was suddenly seized with loss of consciousness and left hemiplegia; consciousness returned gradually, and power is increasing slowly.

Physical Examination.—Heart: Apex impulse is in sixth space, outside midclavicular line; there is a systolic murmur at apex, transmitted into the axilla; action regular and of good force. *Spleen* palpable. Otherwise nothing abnormal except left hemiplegia.

On Admission, pulse, 100; respiration, 34; temperature, 104.5°. *Urine:* specific gravity, 1022; sugar, none; albumin, ten per cent. Microscopical Examination: Some pus; granular and hyaline casts.

March 23. *Temperature* has remained high throughout, 104° to 105.5° F. continuous; unaffected by baths. Numerous petechial spots have appeared. Patient doing poorly. Pulse, 120 to 140. *Died,* March 24.

Autopsy.—Heart: Weight, eleven ounces. Pericardium shows numerous petechial spots. Valves: Mitral is covered with abundant soft vegetations along region of contact and on the cords. Aortic is a little thickened, contracted, adherent, and shows soft vegetations. *Lungs:* Congested. *Spleen* is very soft and friable. *Kidney:* Left is smooth; contains two white infarctions one inch in diameter and several petechial. *Brain:* Numerous minute hemorrhages in pia. Left in-

ternal carotid artery is plugged with a thrombus to its division inside the cranial cavity.

Case XIX.—Aged forty-one; England; housewife; admitted October 14, 1895; died October 16, 1895.

Pathological Diagnosis.—Malignant endocarditis, cardiac hypertrophy, adherent pericardium, infarcts of spleen, kidneys, cerebral hemorrhage, chronic nephritis.

Family History.—Negative.

Previous History.—Typhoid fever six years ago; no rheumatic or malarial history; not alcoholic; no specific taint.

Present History.—Patient was perfectly well till four days ago, when she had a sudden chill, with pain in chest, and cough; chills were repeated upon the two subsequent days, and a watery diarrhœa followed, with six stools a day and vomiting. Dyspnœa has been marked.

Physical Examination.—October 14. *Heart:* Apex displaced outward one-half inch; dulness corresponds. At apex a blowing, systolic murmur is heard and transmitted into axilla. *Lungs:* A few scattered râles anteriorly. Posteriorly over right lung, dulness at base with subcrepitant râles. Otherwise, nothing of importance except swelling and tenderness of left first metacarpo-phalangeal joint, and of ankles. There are some ecchymotic spots on legs.

On Admission, pulse, 112; respiration, 40; temperature, 106°. *Urine:* Specific gravity, 1022; sugar, none; albumin, eight per cent. *Microscopical Examination:* Pus cells; hyaline and granular casts.

October 16. *Temperature* is continuous and high—105° to 106°; baths do not affect it. In bath to-day patient suddenly became rigid on right side and in neck; internal strabismus; breathing labored. *Died* a few hours later.

Autopsy.—Heart: Weight, twelve and a half ounces. Pericardium everywhere adherent; many minute petechial hemorrhages. Valves: Aortic and mitral thick; mitral somewhat retracted, and just above it auricular surface is roughened and covered with fibrin. *Lungs:* Negative. *Liver:* Normal. *Spleen:* Soft; a number of infarctions. *Kidney:* Several infarctions in both; capsule adherent; cortex a little pale; markings indistinct. *Brain:* Large clot two and a half inches in diameter in left hemisphere anterior to fissure of Rolando.

Case XX.—Aged fifty-nine; admitted May 21, 1899; died May 22, 1899.

Pathological Diagnosis.—Malignant endocarditis, chronic nephritis.

History.—Unobtainable, as patient entered hospital in semi-comatose condition and died within a few hours after admission.

Physical Examination.—Patient is poorly nourished and anæmic; she is semi-comatose; respirations labored and rapid; there is marked cyanosis. *Heart:* Nothing abnormal made out, sounds being masked by adventitious sounds in lungs. *Lungs:* Numerous moist subcrepitant, sibilant and sonorous râles over all. Other viscera apparently normal.

On Admission, pulse, 132; respiration, 44; temperature, 105.5°. *Temperature* continued high—104° to 104.5°—until *death*, twenty-four hours later.

Autopsy.—Heart: Pericardium, normal; weight, fourteen and a half ounces. Valves: Mitral has one cusp extremely thickened, with a large ulcerated atheromatous patch on the under surface. Aortic: Patches of fibrin on two cusps and a polypoid mass of fibrin attached to aorta just above the valve. Some thickening of cusps. Muscle very flabby and dotted with minute white spots; looks very fatty. *Arteries:* Atheromatous. *Lungs:* Both œdematous. *Kidneys:* Left capsule adherent; consistence soft and flabby; surface rough. On section: Pale; cortex thin; markings indistinct.

Case XXI.—Admitted November 27, 1893; died December 2, 1893.

Pathological Diagnosis.—Endocarditis, malignant; infarcts of brain, spleen, kidneys; hypostatic pneumonia.

History.—Grippe one year ago; malaria three months ago. Ten days ago pain in foot and shoulder, followed in two days by a severe chill with fever; three days ago, during the night, the patient screamed out, put her hand to her head as if in pain, and suddenly became comatose, the condition she was in upon admission.

Physical Examination.—Negative, except for loss of power of upper extremity; left pupil dilated; there is an eruption of small hemorrhagic spots over body. *Temperature*, 106° F.; typhoid in character; pulse, 100, later rising to 120. *Urine:* Specific gravity, 1020; albumin, fifteen per cent. Microscopical Examination: Granular casts.

Autopsy.—Heart: Weight, nine ounces. Pericardium, normal. Valves: Mitral slightly thickened. *Lungs:* Petechiæ in pleura; pos-

teriorly at base is a small area of consolidation. *Liver:* Normal. *Spleen:* Several infarcts; otherwise normal. *Kidney:* In left a large white infarct; right, two small white infarcts. *Brain:* Pia dotted with petechiæ. Main branch of right sylvian artery filled with thrombus; marked softening about fissure of Sylvius. *Culture* from valves of heart shows streptococcus pyogenes.

Case XXII.—Aged twenty-eight; laborer; admitted June 2, 1893; died June 6, 1893.

Pathological Diagnosis.—Malignant endocarditis, infarction of spleen, hydrothorax, fatty liver.

History.—Father phthisical. No rheumatic or specific history, moderately alcoholic; has had malaria. Three months ago patient had a sudden chill with fever and sweating, swelling and pain in knee; this disappeared after a time, but weakness and shortness of breath have persisted until the present time.

Physical Examination.—Heart shows presence of a double murmur at base and transmitted down the sternum. *Spleen:* Percusses large, and distinct friction-sounds can be heard over this area.

June 5. *Temperature*, 102° and quite regular; no chills; pulse, 120. *Death* occurred after gradual decline of three days.

Autopsy.—Heart: Weight, twelve ounces. Pericardium: Fibrin on surface. Valves: Aortic shows large irregular vegetations and small ulcerations, and on the neighboring endocardium one valve is perforated; ventricular walls hypertrophied. *Lungs:* Left pleura contains one pint clear serum. *Liver:* Normal. *Spleen:* Much enlarged; large irregular white infarctions.

Case XXIII.—Aged twenty-eight; seamstress; admitted February 4, 1896; died May 16, 1896.

Pathological Diagnosis.—Malignant endocarditis, infarction of spleen and kidney, nephritis.

History.—Family, negative. An attack of articular rheumatism three years ago. Two months ago was in hospital with severe dyspnœa, swelled feet, palpitation, dizziness. Present history is a continuation of the above.

Physical Examination.—February 5. *Heart:* Slightly enlarged to the left. There is a loud systolic murmur at apex, transmitted to axilla and heard in back; also systolic at base, loudest at second left

space, transmitted upward. Pulmonary second sound is much accentuated. *Lungs:* Scattered subcrepitant râles. *Liver* and *Spleen:* Both palpable. *Extremities* are œdematous and show old fading hemorrhagic spots. *Urine:* Practically normal.

March 16. Consolidation of lower and middle lobe on right side. No new petechiæ. *Temperature* is of the irregular type, ranging from 100° to 103°, without chills, its general average being about 101°. Patient is failing rapidly.

Autopsy.—Heart: Weight, sixteen ounces. Pericardium contains small quantity of turbid serum; a little recent fibrin at base of heart. Valves: Mitral and its cordæ covered with large vegetations, and a large area of vegetations covers the anterior surface of left auricle, reaching out into auricular appendix. Muscle moderately hypertrophied. *Lungs:* Negative. *Liver:* Negative. *Spleen:* Soft; deeply scarred by old infarcts and several recent infarcts. *Kidney:* Left capsule free, deeply scarred by old infarctions. Cortex: Pale, opaque; markings indistinct.

Case XXIV.—Aged twenty-eight; married; housewife; admitted July 15, 1895; died November 9, 1895.

Pathological Diagnosis.—Malignant endocarditis, infarcts of spleen and kidney, cardiac hypertrophy, adhesive pleurisy.

History.—Father died of pneumonia. The patient had scarlet fever and measles as a child. No gonorrhœa, specific, or alcoholic history. One week ago was exposed to cold and wet, and fainted; next day complained of muscular stiffness. Slight fever; no chills; no headache; bowels normal.

Physical Examination.—July 15. *Heart:* Reduplication of second sounds at base; nothing else. Other viscera normal. Extremities show evidence of acute rheumatism.

July 29. *Heart:* Faint systolic murmur at apex, transmitted to eft. Diastolic at base, transmitted down the sternum. *Urine* contains two per cent. albumin. *Temperature* is of the irregular type—100° to 103°—frequently rising to 105° and 106°, with remissions and chills. No purpuric spots appeared. *Blood:* Hemoglobin, fifty-three per cent.; red cells, 3,060,000 per c.cm.

October 30. A to-and-fro pericardial friction-rub is heard in third and fourth spaces to left of sternum. Petechiæ and ecchymotic spots have appeared on legs. Condition is poor.

November 6. *Urine* contains two per cent. albumin and many casts.

Autopsy.—Heart: Weight, nineteen ounces. Pericardium normal. Valves: Pulmonary—two cusps covered with large masses of granulations, one perforated and the other almost entirely sloughed away. Walls of pulmonary artery and ventricle near the valve studded with granulation-tissue masses. *Lungs:* One small adhesion. There are two infarctions present. *Liver:* Normal. *Spleen:* Two red infarctions. *Kidneys:* Evidence of slight chronic inflammation.

Case XXV.—Aged thirty years; housewife; admitted December 17, 1900; died January 7, 1901.

Family History.—Negative.

Previous History.—Never suffered from dyspnœa. Six months ago was suddenly seized with a sharp, cutting pain below right costal margin and extending to umbilicus; pain sharp and agonizing, lasted three days; vomiting occurred repeatedly; jaundice developed with fever, but with no chills. After a week, symptoms subsided except the fever, and she has ever since had afternoon temperature. One month later she had a similar attack, lasting fourteen hours only.

Present Illness.—Six weeks ago she had rheumatism of the ankles, the joints being tender and swollen, and to a less extent the knees; this was accompanied by high fever and sweating, especially at night; since that time she has been short of breath and has had cough with muco-purulent expectoration. No œdema. For some time previous to rheumatic attack she had been losing flesh, had afternoon fever, and just previous to the attack had hard shaking chills. She was admitted first to surgical division with diagnosis of cholelithiasis, but operation was deemed imprudent because of her cardiac condition, and she was transferred to the medical division.

Physical Examination.—Heart: Maximum impulse in fifth space, three and a half inches to left of median line; left limit of dulness corresponds; right limit is at right border of sternum. There is also an impulse in fourth space, five inches to left of midsternum. Action is regular, occasionally intermittent. There is a very loud blowing systolic murmur at apex, heard also over entire chest, and as low down on both sides as the costal margins, and over left chest posteriorly. Pulmonic second sound is accentuated and reduplicated. *Pulse* is

regular, small, soft, and occasionally intermittent. *Lungs:* Moist subcrepitant râles over both. *Spleen:* Percusses large; edge is felt one inch below costal margin. *Abdomen:* A mass probably containing fluid below right costal margin, over the region of gall-bladder, and tender to palpation.

On Admission, pulse 128; respiration, 38; temperature, 103.5°. *Urine* contains a trace of albumin and a few hyaline and granular casts.

December 25. Patient complains of pain in left elbow, and subsequently in knees. *Temperature* is irregular and of the hectic type, running between 100° and 104°. *Blood:* Leucocytes, 15,000 per c.cm. *Blood-culture* shows only a contamination by atmospheric bacilli. This patient was transferred to surgical division and operated upon for cholecystitis. Upon opening abdomen the liver presented in the wound, large, smooth, and congested. Gall-bladder normal. Patient subsequently died and post mortem disclosed marked endocarditis.

Case XXVI.—Aged forty-three; German; housewife; admitted April 14; died April 21, 1900.

History.—Family, negative. Previous, negative; not alcoholic; no specific taint; no rheumatic history.

Present History.—Three and a half months ago began to have swelling of hands and feet and shortness of breath. For past six days has been worse, with severe headache, frequent vomiting, and prostration, with fever and sweating.

Physical Examination.—Heart: Dulness normal; action rapid, regular, overacting. A loud blowing systolic murmur is heard at apex, also a diastolic, both of which are transmitted to axilla. A double murmur is heard over both valves at the base, transmitted down the sternum. Pulmonary second sound is accentuated. *Pulse* is rapid, regular, Corrigan in character.

On Admission, pulse, 144; respiration, 44; temperature, 104.5°. *Urine:* Negative. From this time on patient had numerous petechial spots, also a few large ecchymoses, increasing delirium and jaundice. At end, bleeding from the nose was almost constant. *Temperature* ran irregularly from 101° to 105°. *Blood Examination:* Hemoglobin, thirty per cent.; leucocytes, 11,400; Widal test, negative. *Culture:* No growth upon two trials. *Died* April 21. No autopsy could be obtained.

Case XXVII.—Aged forty-eight; laborer; admitted August 13, 1900; died September 11, 1900.

History.—Family history is negative. Patient had gonorrhœa four years ago; formerly drank moderately, never to excess. Twelve years ago had acute inflammatory rheumatism involving a number of joints, but has been perfectly well until present illness. This began seven weeks ago with pain and swelling of ankle-joints, chills, and fever. These he has had almost every day since. The pains have diminished.

Physical Examination.—Heart: Apex impulse is in fourth space, four and a half inches to left of midsternum. Action rapid, regular; there is a systolic and diastolic murmur heard at apex; former transmitted into the axilla. A loud diastolic murmur is heard at base and transmitted down the sternum. Pulmonary second sound is weak. *Pulse:* Corrigan. *Liver:* Percusses from fifth space to below free margin; edge felt two and a half inches below. *Spleen:* Percusses large; edge felt one inch below costal arch; consistency firm. *Surface:* Scattered over entire body, except face and neck, is a hemorrhagic eruption.

On Admission, pulse, 88; respiration, 20; temperature, 99°. *Urine:* Specific gravity, 1012; sugar, none; albumin, twenty-five per cent. by volume. Microscopical Examination: Many large hyaline and granular casts; some pus. Diazo reaction present. Indican, very strong reaction. From this time on the temperature continued to run an intermittent course, rising almost every day to 105° and 106°, and accompanied by a chill. Urine contained from fifteen to twenty per cent. of albumin. Numerous new crops of petechiæ appeared, as well as epistaxes. Increasing emaciation, prostration, and at last delirium supervened. *Blood Examination:* leucocytes, 16,500. *Cultures* showed no growth in repeated trials; no malarial organisms found.

Case XXVIII.—Aged thirty-three; German; housewife; admitted October 20, 1900; died December 1, 1900.

History.—Family history good, as well as previous history, with exception of an attack of pneumonia five years ago. Two weeks before admission illness began with nausea, vomiting, headache, prostration, and pain in both great toes, extending up legs, also fever and sweating. No diarrhœa; no epistaxes.

Physical Examination.—Heart: Apex impulse is in fourth space, three inches to left of median line; regular, of good force; no murmurs. *Spleen:* Percusses little; large edge is felt just below margin. Other viscera apparently normal.

On Admission, pulse, 120; respiration, 28; temperature, 101.5°. *Urine:* Normal. After ten days temperature reached normal; then with chill it rose rather irregularly and ran an irregular course of 100° to 105°. The chill was not repeated. Marked pain and tenderness developed over the course of the left anterior crural and sciatic nerves.

November 19. *Heart:* Apex impulse is visible and forcible in fourth space, three inches to left of middle line. There is a loud blowing systolic murmur heard at apex, transmitted to axilla and heard over the entire chest and base of the heart. Pulmonary second sound is accentuated. *Pulse* is small, rapid, irregular, no tension.

November 27. There is a loud blowing diastolic murmur over whole precordium. There are no petechiæ.

November 30. Patient became suddenly oppressed for breath and died. *Blood:* No Widal on numerous examinations. No malarial organisms found. Growths on cultures proved to be contaminations. Leucocytes, 17,800 per c.cm. No autopsy could be obtained.

Case XXIX.—Aged thirty-four; admitted May 1, 1898; died May 23, 1898.

History.—Family, negative. No tuberculous or specific infection; moderate alcoholic habit. An attack of malaria ten years ago and others since. Four days before admission the patient had a chill, with vomiting and profuse sweating, pains over entire body, and headache. Next day two more chills occurred.

Physical Examination.—May 2. *Heart:* Apex impulse in fourth space, four inches to left of median line; action is regular, of good force; there is a loud systolic murmur heard all over the precordium, loudest at apex, and transmitted into the axilla; also heard over the left chest posteriorly. Pulmonary second sound is accentuated. *Pulse* is regular, soft; no thickening. *Spleen:* Percusses a little large; edge is just palpable.

On Admission, pulse, 138; respiration, 16; temperature, 104.5°. *Urine:* Negative. Course of disease is marked only by progressive asthenia and appearance of petechial spots. The *temperature* continued

high—104°—was typhoid in type, and reacted well to baths. *Blood:* No reaction to Widal's test on repeated trials. No growth in cultures on three trials. *Leucocytes*, 6,000 per c.cm. No malarial parasites found. No autopsy could be obtained.

Case XXX.—Aged 29; Ireland; admitted March 3, 1896; died March 10, 1896.

History.—Family, unknown.

Previous History.—Normal; no alcoholic, specific, or rheumatic history.

Present Illness is of two months' duration, with malaise, headache, vomiting, and delirium; no chills; no history of exposure or traumatism.

Physical Examination.—Heart: Apex impulse is in fifth space, within midclavicular line; action regular, of fair force. There is a loud systolic murmur at apex, also over the base, the latter being musical in character.

On Admission, pulse, 110; respiration, 30; temperature, 102°. *Urine:* Negative. Course of disease is as above, with a few petechial hemorrhages. *Temperature* ranged from 103° to 107°, and reacted well to the baths received. *Died* March 10. No autopsy obtainable.

Summary.—From the accompanying cases, it is evident that symptomatically there are a number of types of the disease. One of sudden onset, short duration, with high continuous temperature, headache, splenic enlargement, cutaneous hemorrhages or bleeding from the mucous membranes, together with evidence of inflammation of the endocardium; here the endocarditis is but one manifestation of a severe general infection which rapidly goes on to a fatal termination. The second form is of much longer duration, persisting for weeks, or sometimes for months, beginning gradually with irregular fever, which often becomes remittent or even intermittent, and is accompanied by chills and sweating, gradual loss of flesh and strength, splenic tumor, hemorrhagic eruptions and endocarditis; this form is distinctly septic in its action, and presents an entirely different picture from the former. A third class is that of pneumococcus or micrococcus lanceolatus infection, where the causative factor is pneumonia or meningitis, or an association of the two; here we see severe acute pulmonary symptoms, or signs of intense cerebral irritation, with the addition of endocarditis, enlargement of the spleen, petechial hemorrhages and septic infarctions.

Still a fourth variety is where the local endocardial signs and symptoms are of chief prominence, the constitutional affection being slight, except for the evidence of poor circulation.

Etiology.—Of the 32 cases enumerated here, eight occurred coincidently with rheumatism; one apparently with a strain of the back accompanied by hematuria; seven gave a history of old rheumatic attacks; three of having had scarlet fever or diphtheria; two of palpitation and dyspnœa; seven of typhoid fever, influenza, or malaria; the remainder having apparently always been well.

So the endocarditis is in all probability a pre-existing factor in most of the cases; there are instances, however, where there is no reason to suspect that a previous inflammation of the endocardium existed; and we find cases where cardiac murmurs develop during the course of the disease, where no abnormal condition existed in the heart at the first examination. In 16 of the 32 cases reported here, the cardiac signs found upon physical examination were verified by post-mortem findings. While the greater number of murmurs represent lesions of the mitral and aortic valves, we must bear in mind that in malignant endocarditis, unlike the simple form of the disease, we find evidence of endocarditis of the right heart, affecting the tricuspid and pulmonary valves; of our nineteen autopsies, the pulmonary valve was affected twice, the tricuspid once, and in one case a tricuspid murmur was obtained where autopsy could not be gotten.

Emboli are of frequent occurrence, but vary greatly as to the seriousness of their results; when occurring in the cerebral arteries, coronary arteries or lungs, they may be quickly fatal; they occur, however, most frequently in the spleen and kidneys. The lodging of an embolus is accompanied by sudden sharp pain in the part affected, together with a rise of temperature and frequently a chill. Such an infarct is not infrequently followed by death of tissue and abscess, thus forming a new focus of infection. Among our nineteen autopsies there were sixteen showing emboli—one in the brain, two in the lung, one of the heart muscle, the others occurring in the spleen and the kidneys, together with one in the liver.

Hemorrhages occurred in sixteen of the thirty-two cases enumerated here, the bleeding being mostly in small pin-head spots of the petechial variety, occurring in successive crops; in a few instances, however,

larger ecchymoses were to be seen. Bleeding from the mucous membranes occurs, usually as epistaxis; less frequently we find hemorrhage from the lungs, from the kidneys, or into the brain.

The *Temperature* may rise suddenly and remain continuously high, without remissions, until death ensues; this course of temperature is generally indicative of a severe infection of short course, and is unaccompanied by chills. It simulates closely the typhoid type and is often the cause of mistaken diagnosis. Or the temperature is irregular, may be low or high, accompanied by remissions or frequently by intermissions, sometimes occurring daily, so that there is a daily rise and fall of five or six degrees; these marked remissions are often accompanied by chills and profuse sweats. The irregular type of temperature accompanies the cases of considerable standing, although occasionally they are of but short duration.

Splenic Enlargement occurs in about half of these cases, with greater frequency, however, in the prolonged ones; palpation of the spleen often elicits pain from previous infarction or from congestion.

Nervous Symptoms.—In many cases apathy precedes delirium, which is of an active character, or is low and muttering; the active delirium occurs in cases of severe general infection of the typhoid type, while mutterings and hallucinations take place in the prolonged disease of septic type. Coma or convulsions or death may occur at any time, from embolism or hemorrhage of one of the cerebral arteries. With meningitis added, the nervous symptoms take on a more severe aspect, with cerebral irritability, convulsions, stupor, or coma, retraction of the head and neck, dilated pupils which do not react, photophobia, strabismus, excessive hyperæsthesia, marked rigidity of the muscles of back and extremities, opisthotonos, etc.

The *Pulmonary Symptoms* are those accompanying any severe endocarditis, and are caused by venous congestion of the lungs and insufficient oxygenation of the blood; they are evidenced by cyanosis, dyspnœa, cough, and muco-purulent expectoration, and moist râles in the dependent portion of the chest. With pulmonary infarct we have sharp pain, sudden dyspnœa, and hemoptysis; in case death does not ensue, evidence of consolidation follows, with, perhaps, pleuritic effusion or empyema. Where pneumonia occurs its characteristic signs are added to the above.

The *Blood Examination* shows an increase in leucocytes in all of the cases; those of high continuous temperature being (with but one exception) over 15,000 per c.cm., and frequently 20,000, 25,000, or 30,000 per c.cm. A count of less than 15,000 per c.cm. belongs to the irregular and protracted group, although occasionally a member of this class exceeds that figure. The red cells vary considerably, being in most cases between 3,000,000 and 4,000,000 per c.cm., one case being as low as 2,500,000 per c.cm. The hemoglobin corresponds, the blood examination showing changes of a mild secondary anæmia. In Jackson's series of fifty-nine cases, he found the leucocytes regularly increased from 16,000 to 20,000 per c.cm.; this increase does not hold in the cases cited here, and Babcock says ("Diseases of the Heart") that though leucocytosis is the rule, where septicæmia exists and there is but a slight leucocytosis or none at all, malignant endocarditis is to be suspected.

Culture.—In twenty-four cases from which blood was taken for culture, growths were obtained in twelve. Cultures taken from the viscera of these cases which came to autopsy, showed the same findings, and in no instance did the two results differ; one case showed pyogenic organisms taken from the viscera in which no blood specimen was taken. There were staphylococcus pyogenes aureus or albus, six; streptococcus pyogenes, two; micrococcus lanceolatus, four cases. The *Urine* generally contains a trace of albumin, with a few hyaline and granular casts; a few cases show a marked nephritis, possibly independent in origin, possibly due to the irritation of the tubules by circulating bacteria, or from infarctions, and in two cases there was a considerable quantity of blood in the urine. Where emboli occur with softening and abscess, we find pyuriã.

Concerning the use of antistreptococcus serum I have collected from the literature twenty-four cases; seven have resulted in recovery and seventeen have died. In some, the recovery seemed to follow the injection of the serum; in others, the injection apparently did no good, or did decided harm. Beneficial results have been obtained in enough cases to warrant its receiving a more thorough trial.

Conclusions.—1. That malignant endocarditis is a disease of bacterial origin; that it differs from simple acute endocarditis in the extent of endocardial inflammation and tissue necrosis; in the fact that

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TABLE OF PREVIOUS CASES, SHOWING SYNOPSIS OF HISTORY, COURSE OF DISEASE, AND POST-MORTEM FINDINGS.

Case.	Age.	Sex.	Occupation.	Former Diseases.	Alcohol.	Gonorrhœa.	Syphilis.	Family History.	Direct Cause.	Onset.	Skin before Albuminuria.	Invasion and Course.	Spleen.	Chills.	Cutaneous Hæmorrhage.	Temperature.	Hæmoglobin, Leucocytes, and Red Blood-cells.	Urine.	Varieties of Organism.	Physical Signs of Heart.	Pathological Findings in Heart.	Infarcts.
I	57	M	Attendant	Measles, pertussis	Moderate	No	No	Tubercular		Sudden	7 days	Vomiting of blood, pain under left rib	No	No	No	Irregular, moderate	19,000	1020, copious	Staphylococcus pyogenes albus or aureus	Pericardial friction	Small vegetations on mitral; pericardium normal.	
II	33	F	Housewife	Rheumatism	No	No	No	Negative	Rheumatism	Sudden	5 days	Vomiting, dizziness, joint-pains	No	No	Yes	High, regular	19,000	1015, negative	Staphylococcus pyogenes albus or aureus	Mitral systolic		
III	32	I		Frequent diarrhœa, seven months' child, rheumatism				Negative	Diarrhœa	Sudden	7 days	Headache, diarrhœa	Yes	No	Yes	Low, irregular	22,000	1017, negative	Staphylococcus pyogenes albus or aureus	Systolic over pulmonary		
IV	18	F	Housewife	Measles, scarlet fever, diphtheria, typhoid, eclampsia	No	No		Negative		Slow	7 days	Headache, diarrhœa, fever	Yes	No	No	Continuous, high	31,000	Trace albumin, bloody	Staphylococcus pyogenes albus or aureus	Mitral, systolic; tricuspid, systolic		
V	56	M	Butcher	Measles, slight joint pains	Moderate	Yes	No	Negative		Slow	3 months	Fatigue, dyspnœa, œdema	No	No	No	Low	27,000, 4,200,000	Trace albumin, few hyaline and granular casts	Staphylococcus pyogenes, albus or aureus	Mitral, systolic; aortic, diastolic		
VI	19	F	Bookkeeper		No				Rheumatism	Slow	3 months	Dyspnœa, rheumatism, hemiplegia	No	No	No	Irregular, moderate	12,000, 3,300,000	Trace albumin, few hyaline and granular casts	Micrococcus lanceolatus	Mitral, systolic	Thick fringe of vegetations on mitral.	Infarct of spleen and kidney.
VII	22	F		Measles, scarlet fever, rheumatism	No				Rheumatism	Slow	3 months	Previous endocarditis; joint-pains, dyspnœa, palpitation	Yes	No	Yes	Irregular, low	10,000	Trace albumin, negative	Micrococcus lanceolatus	Mitral, systolic		
VIII	44	F	Housewife	Typhoid, influenza		Slight	No	No		Sudden	11 days	Headache, chill, fever	No	Yes	No	Chills, continuous, high	19,000	Albumin, four per cent., few hyaline and granular casts	Micrococcus lanceolatus	Mitral, systolic	Vegetations on mitral	Infarct of lung, spleen and kidney
IX	12	T		No previous illness, though "not strong"				Sudden		Sudden	4 weeks	Chills, vomiting, irregular fever	Yes	No	No	Irregular	12,000, 3,500,000	Trace albumin, few hyaline and granular casts	Streptococcus pyogenes	Mitral, systolic		
X	24	F	Housewife	No previous illness		Moderate	No	No	Negative	Menstruation, acute indigestion	Sudden	7 days	Vomiting and abdominal pain	No	No	Yes	High and continuous	17,000	Trace albumin, few hyaline and granular casts	Streptococcus pyogenes	Mitral systolic	Minute vegetations on aortic; fibrin on mitral and perforation, infarcts in wall.	Infarct of spleen.
XI	31	F	Housewife	Malaria, rheumatism	No	No	No	Negative	Rheumatism		7 weeks	Rheumatism, chills, septic	Yes	Yes	No	Chills, high, remittent	10,000	1015, negative		Mitral, systolic, and presystolic, palpoid	One aortic cusp hypertrophied and polypoid.	Cerebral embolism.
XII	42	F		Dyspnœa for years, and œdema	No	No	No	Negative	Attack of dyspnœa and œdema	Sudden	10 days	Dyspnœa and œdema	No	No	No	Continuous	Hæmoglobin 75, 8,000	Trace albumin, few hyaline and granular casts		Mitral, systolic and presystolic	Mitral and aortic valves thickened, atheroma of coronary arteries.	Infarct of lung.
XIII	44	M	Machinist	Measles, scarlet fever, diphtheria, malaria	Yes		Yes	Negative	Strain and hæmatoma	Sudden	10 days	Old nephritis, over-exertion	No	Yes	Yes	Irregular, high	Hæmoglobin, 90%, 12,000, 4,500,000	Trace albumin, 3 per cent.	Double murmur at apex	Large vegetations on aortic	Infarct of both kidneys.	
XIV	21	M.	Plumber	Malaria		Yes	Yes	No	Negative	Malaria (?)		6 weeks	Fever and sweats, chills at intervals	Yes	Yes	No	Irregular	10,000	Trace albumin, negative		Mitral, systolic.		
XV	20	F		Measles and scarlet fever, palpitation	No		No	No	Negative		Sudden	3 days	Previous endocarditis; for years palpitation and dyspnœa; œdema	No	No	Yes	Continuous	Hæmoglobin, 85%, 23,000, 3,700,000	Trace albumin, few hyaline and granular casts		Systolic and presystolic, mitral	Mitral greatly stenosed; aortic greatly stenosed; one cusp perforated.	Infarct of lung.
XVI	41	M.	Whitewasher	Malaria or cystitis			Yes		Negative		Slow	2 weeks	Chill, fever, œdema		No	Yes	No	Chills, irregular	Ten per cent. albumin, hyaline and granular casts.			Mitral, systolic	Enormous vegetations on mitral	Infarct of heart, liver, and spleen.
XVII	21	M.	Fireman	Rheumatism		Yes		No	Negative		Slow	3 months	Previous endocarditis, dyspnœa, weakness		No	Yes		Irregular	Negative		Mitral, systolic; double aortic	Mitral thickened and retracted; aortic eroded and calcareous; adherent pericardium.	Infarct of spleen.
XVIII	22	M		Rheumatism		Yes	Yes	Yes	Negative			8 days	Chills, fever, headache, diarrhœa	Yes	No	Yes	Continuous		Albumin, ten per cent., granular and hyaline casts.		Mitral, systolic	Vegetations on both mitral and aortic	Infarct of kidney
XIX	41	F	Housewife	Typhoid		No	No	No	Negative		Sudden	4 days	Chill, fever, diarrhœa, dyspnœa, hemiplegia	No	No	No	High, continuous		Negative		Mitral, systolic	Mitral thickened and retracted	Infarct of spleen and kidney.
XX													In coma		No	No	High				Nothing	Large ulceration of mitral	
XXI			Housewife	Grippe, malaria					Rheumatism	Sudden	10 days	Joint-pains, fever, in coma upon admission		No	Yes	No	High, continuous		Albumin, fifteen per cent., hyaline and granular casts.		None	Mitral slightly thickened	Infarct of spleen, kidneys.
XXII	25	M		Malaria		No	No	Tubercular	Rheumatism	Slow	2 months	Dyspnœa, fever		Yes	No	No	Regular, low		Normal		Double aortic	Vegetations and ulceration of aortic.	Infarct of spleen.
XXIII	28	F	Seamstress	Rheumatism (dyspnœa, œdema)		No	No			Slow	2 months	Dyspnœa, palpitation, œdema		Yes	No	No	Irregular		Normal		Mitral, systolic; aortic, systolic	Vegetations on mitral and on cords	Infarct of spleen and kidneys.
XXIV	28	F	Housewife	Scarlet fever, diphtheria		No	No	No		Sudden	7 days	Muscular pain		No	Yes	Yes	Irregular	Hæmoglobin, 85%, 5,000,000	Albumin, two per cent.		Mitral, systolic; diastolic at base	Mitral normal; pulmonary has vegetations and perforations.	Infarct of spleen and kidney.
XXV	30	F.	Housewife	Rheumatism		No	No	No		Rheumatism	Slow	6 weeks	Chill, fever, sweat		No	No	Irregular, high	13,000	Trace albumin, few hyaline and granular casts		Mitral, systolic		
XXVI	43	F.	Housewife	Rheumatism		No	No	No			Slow	3 months	Dyspnœa and œdema; much worse during last two weeks		No	No	Irregular, high	Hæmoglobin, 30%, 11,400, 18,500	Albumin, twenty per cent., large hyaline and granular casts		Mitral, systolic; aortic, diastolic		
XXVII	48	M.	Laborer	Rheumatism			No	No		Rheumatism		7 weeks	Joint-pains, fever, chills		Yes	Yes	Irregular, chills						
XXVIII	33	F	Housewife	Pneumonia		No	No	No		Rheumatism	Sudden	2 weeks	Vomiting, headache, joint-pains	Yes	No	No	Irregular	17,000	Normal		Mitral, systolic		
XXIX	34	M.		Malaria		Yes		No			Sudden	4 days	Vomiting, swelling, chill, general pains	Yes	No	Yes	Continuous	6,000	Normal		Mitral, systolic		
XXX	29	M.					No	No			Slow	2 months	Headache, vomiting, delirium		No	Yes	Continuous		Normal		Mitral, systolic		
XXXI																						
XXXII																			Staphylococcus pyogenes albus		Vegetations on aortic; atheroma of coronary arteries	Infarct of spleen; petechial hemorrhages in all viscera.
																			Micrococcus lanceolatus		Mitral shows vegetations, perforation and cyst; aortic, tricuspid, and pulmonary are thickened.	

the right heart is more often attacked; and in the more frequent embolic processes which are septic in character, in which micro-organisms are found.

2. That there is nothing in the condition distinctive of any particular variety of germ causing it.

3. That primary cases are rare, though they do exist; most cases, however, accompanying rheumatism, septicæmia, or the acute infectious diseases.

4. That almost all are fatal—the ones due to severe infection, in a few days; the septic ones in a few weeks. The first variety have a leucocytosis of 15,000 or over, the latter usually being below that number, some being very slight.

5. That emboli and hemorrhages are of frequent occurrence, and may be fatal in their result.

6. That the urine usually shows evidence of nephritis, and may contain blood and pus from hemorrhage or infarct.

7. That treatment is usually unavailing, excepting the serum therapy, which has not yet been tried for a sufficient time.

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XVI.

REPORT OF A CASE OF GLANDERS.

By Philip van Ingen, M.D., late House Physician.

The following case, occurring in the service of Dr. G. A. Tuttle, with whose permission I report it, presents features which are not very definitely described in the rather vague accounts of glanders as given in the various text-books of medicine. The case was watched and studied very carefully, but the diagnosis was not made till a few days before death.

The patient, James C., aged twenty-eight, who gave his occupation as a cook, was admitted to the medical wards of the Presbyterian Hospital, June 25, 1903. His family history was negative. He lived in Westchester County, New York, a district where malaria is rife, but which is otherwise healthful. His drinking-water was obtained from a deep well. There had been no cases of "fever" in the vicinity. His habits were fairly good.

Ten years ago he had his first attack of malaria, since which time there had been a return of "chills and fever" nearly every year, of only slight severity. His last attack he thought was about four weeks ago. It lasted only a few days, after beginning treatment with quinine.

Two weeks before admission to the hospital he began to feel miserable. At first there were merely malaise and apathy, which, however, gradually increased in intensity. One week before admission he felt so miserable that he called in a physician, who found his temperature 104.5° F. During the week before he came under our observation his temperature is said to have continued between 102° and 103° F. He complained of a general feeling of soreness, and coughed a good deal, the sputa being muco-purulent, never rusty or blood-streaked. There had been no chills, no epistaxis or vomiting. The bowels were regular. As there were abundant subcrepitant and sibilant râles over both lungs, with high fever and great prostration, he was thought to

have broncho-pneumonia. During the last three or four nights before admission he was delirious.

When admitted to the wards with a temperature of 105° F., pulse 112, respiration 30, he appeared to be a fairly well-nourished man, very much prostrated and apathetic. He looked very ill. The tongue was moist and coated with whitish fur, especially over the back part. Along its margin were four or five yellowish areas from one-fourth to one-half inch in diameter, covered with a yellowish membrane which was quite firmly adherent. At the left angle of the mouth was a similar yellowish area. These patches were slightly elevated and there seemed to be no loss of substance. There was a good deal of congestion of the pharynx and tonsils, but no exudate was visible. The superficial lymph-nodes were not enlarged. The apex impulse of the heart was in the fifth intercostal space, three and one-half inches to the left of the median line. The heart was acting irregularly, occasionally intermitting, and a soft systolic murmur could be heard at the apex which was not transmitted. Of the two basal sounds the aortic was the louder. The pulse was rapid, irregular, full and soft, not dicrotic, and the vessel wall was moderately and diffusely thickened. Over both lungs a moderate number of subcrepitant and sibilant râles were heard. There was no appreciable dulness or change in breath-sounds. The rounded edge of the spleen could just be felt at the costal arch. Over the right deltoid region was a slightly reddened area apparently due to irritation from a hypodermic injection, which soon disappeared. The right knee was considerably swollen, and was held in a position of extension. It was hot, but not reddened, exquisitely tender, and measured at midpatella one-half inch more than the left. There was also considerable tenderness on deep pressure over the lower half of the right femur, but no thickening of the bone could be made out. There was no appreciable tenderness over any other bone, nor was any other joint involved. Scattered over the entire trunk was a diffuse eruption composed of small macules about the size of a pin-head, lying deep in the substance of the skin. They disappeared almost completely on pressure, and there was no tendency to form large patches. Subsultus was marked. The physical examination was otherwise negative. The extremities were free from the eruption. There was no stiffness or tenderness of the muscles of the neck, nor was there any coryza.

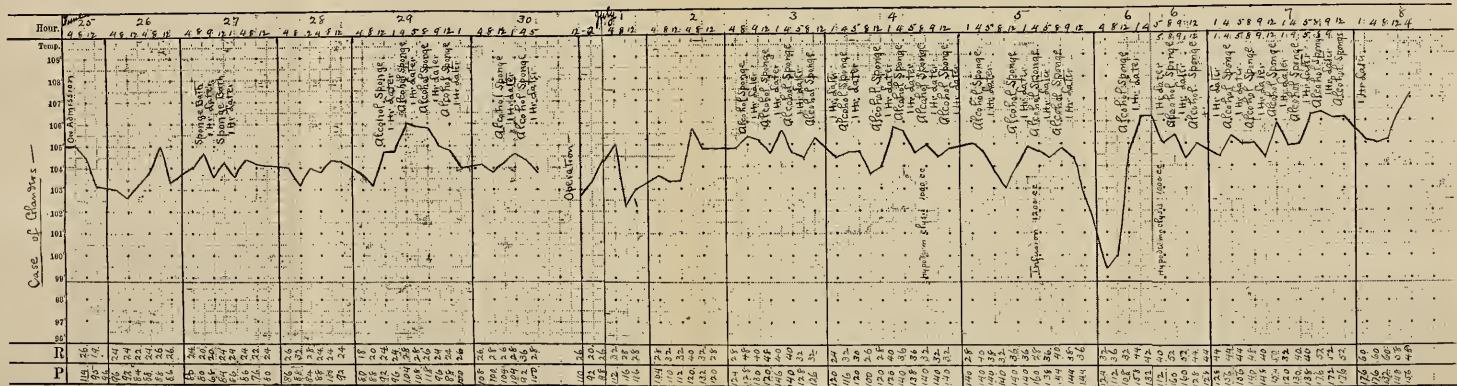
The urine was of a specific gravity of 1020, contained a heavy trace of albumin, a considerable number of hyaline and granular casts, and gave a faint indican reaction. No glucose was present. Examination of the blood on the morning after admission showed 7,900 leucocytes. No malarial plasmodia were found, and the Widal reaction was negative. The leucocytes from this time on never rose above 10,500.

During the three days after admission the temperature ran between 103.5° F. and 105° F., once falling to 102.7° F. The pulse was less rapid, never being above 100, and varying between 76 and 100. The patient presented more and more of the typhoidal condition. There was low muttering delirium at night, and by day he was slightly irrational and hard to arouse. The tongue became dry, cracked, and tremulous; the abdomen a little distended. There was a good deal of paroxysmal cough with slight muco-purulent expectoration, which did not contain tubercle bacilli. The swelling of the right knee became slowly more marked. The joint was now held in a position of semi-flexion; tenderness and heat also increased. The tenderness over the lower half of the right femur also continued.

On June 29th (fifth day in hospital) the knee had considerably increased in size, and for the first time there was noticed a good deal of induration of the soft parts, with redness, about the outer and posterior aspects of the joint. An exploring needle was introduced into the joint with aseptic precautions, and about two and one-half ounces of thick, sticky, yellowish pus containing small fibrinous masses was obtained. The yellowish areas on the tongue and at the angle of the mouth had enlarged. The deep macular eruption noted on admission had steadily faded and appeared now only as a faint dull discoloration of the skin, over which was a very scanty fine desquamation. The temperature this afternoon reached 106° F.

Operation was advised, but owing to delay in the friends reaching the hospital it was not performed till the following evening. On the morning of the day of operation, June 30, the left wrist was swollen, red, hot, and tender; active and passive motion were intensely painful. There were no signs of lymphangitis.

The patient was now transferred to the service of Dr. Hawkes, with whose permission the subsequent history is given. Incision of the knee-joint and wrist was performed by Dr. Hawkes on the evening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of June 30, and a considerable amount of sticky, yellowish, thin pus, without odor, and containing large fibrin masses, was evacuated from both joints. The patient did badly after the operation. The temperature remained high for the most part, between 104° and 106° F., once reaching 106.4°, and registering 107.2° F. just before death. Alcohol sponging had no effect upon the temperature or pulse, which latter ranged between 110 and 176.

Two days after operation the patient became semi-comatose. At times he was very delirious, but for the most part he lay in a state of semi-coma from which he could with difficulty be aroused. The discharge from the wounds was at first thin, yellow, odorless, and rather scanty, but in forty-eight hours it had become more profuse, thick, and foul.

July 4. A deep, boggy swelling was discovered just above the right ankle. It was incised, and a small amount of thin yellowish pus was evacuated. It was not well walled off, but extended for some distance between the muscles of the anterior tibial group. A second abscess, which had appeared over the right malar region, was incised and a small amount of thin yellow pus evacuated. During the afternoon a number of reddened areas, varying in size from one-fourth to three-fourths of an inch in diameter, not well circumscribed, were noticed over the trunk, shoulders, and thighs. They were not elevated, but gave a distinct sensation of deep induration. The original deep macular eruption had entirely disappeared. The patient was now in an intensely septic condition, and comatose. Breathing was labored, rapid, and entirely through the mouth, which had become dry and covered with thick adherent mucus. Crusts had formed at the angles of the mouth and in the nostrils. No ulcers could be seen in the anterior nares.

July 6. Another deep-seated, boggy swelling appeared on the dorsum of the right forearm just above the wrist. This was incised, and a small amount of thin, reddish-yellow pus was found lying diffusely between the deeper muscles. None of these abscesses could be traced to bone. The irregular, reddened, indurated areas had now increased in number. They were slightly elevated. The next morning they presented for the first time the following characteristic appearance. Scattered over the whole body, but most numerous on the face and

shoulders, were papules and pustules, from one-eighth to one-quarter of an inch in diameter, and with reddened and inflamed bases. Many of them were surrounded by whitish, firm areolæ from one-half to one

FIG. 1.

inch in diameter. The pustules were of a yellowish color, and some of them were umbilicated. These are well shown in the accompanying photographs by Dr. H. S. Arnold.

With the appearance of this eruption the question of infection from glanders was inquired into, and it was found that the patient was not a cook, as he had stated on admission, but a fish-dealer. He owned a horse which he cared for himself, and which was shot by the order of the Health Department one week before the patient was admitted, because it was suffering from glanders.

The patient steadily became worse, and died the following day, a picture of the most intense sepsis.

Three cultures were made from the blood during life. Those of June 27 and June 30 were both sterile. The third, taken July 5, gave

FIG 2.

a characteristic growth on potato and in milk, and morphologically proved to be a pure growth of bacillus mallei.

Three cultures were made from the pus from the joints. The first, from that obtained by aspiration of the joint, is reported as showing "a growth of a bacillus of unknown variety. Does not give characteristic appearance of glanders bacillus on potato and does not coagulate milk. Probably a contamination." The second, from the pus obtained on incision of the joint, showed a growth of pure white colonies and some yellow colonies, the former proving to be staphylococcus pyogenes albus, the latter sarcinæ. The third was made from the discharge from the joints, on July 6, and showed a very abundant and mixed growth, but no bacillus mallei could be isolated.

Immediately after death a culture was made from the pus of an unbroken pustule which gave a characteristic brownish growth on potato, and rapidly coagulated milk, with formation of a yellowish growth on the surface. Morphologically the bacterium was characteristic—bacillus mallei. A pustule was also excised and sections were made which showed the presence of the bacillus mallei in the substance of the pustule.

Unfortunately, an autopsy was not permitted.

XVII.

A CASE OF EXTRACTION OF AN INTUBATION TUBE FROM THE RIGHT BRONCHUS.

THE ULTIMATE RESULT OF A SERIES OF OPERATIONS FOR RESTORATION OF THE LARYNX.

By A. J. McCosh, M.D.

In the "Annals of Surgery," Vol. XXXIV, there is reported a case of restoration of the entire larynx and upper part of the trachea by means of several plastic operations and skin-grafting. The following is a brief synopsis (p. 652).

R. C.; aged fourteen. In 1895 the operation of laryngo-fission was performed for multiple papillomata of the larynx. At that time tracheotomy through the third and fourth rings was done, and a tube inserted. Since then the tube has been constantly worn. As far as is known, no attempts were made to dispense with it. On inspection through the mouth with a laryngeal mirror it was impossible to see the opening into the larynx on account of its closure by the epiglottis, which was tightly bound over it by cicatricial tissue. A probe passed through the tracheotomy opening met a complete obstruction half an inch above. It was evident that the windpipe from the epiglottis down to the second ring of the trachea was completely obstructed. As the boy was desirous to breathe through the natural opening, he was referred to me for treatment by Drs. Weightman and J. C. Sharpe.

Operative procedures were begun in November, 1900. On the 27th, chloroform was administered through the tracheotomy tube. A three-inch incision was made in the median line of the neck from half an inch above the tracheal fistula to the hyoid bone. The larynx was found much shrunken and deformed. On cutting into it, no canal could be found. The windpipe had become much contracted, and the cartilages enclosed a solid tube of cicatricial tissue without a sign of

calibre or mucous membrane. Attempts were made to pass a probe upward through the glottis, but this could not be accomplished. In order to give freer access the hyoid bone was divided. While the laryngeal walls were held apart, some of the cicatricial tissue was excised. Considerable bleeding, especially from the upper part of the incision, followed, and it was considered best to simply tampon the new and narrow canal with a strip of gauze. Communication into the trachea had not been established, as the incision extended down to the first ring only of the trachea, and consequently no special efforts were needed to prevent blood trickling into the lungs. The wound in the larynx was kept open with difficulty with gauze until December 10, when chloroform was again administered, the laryngeal walls spread open by retractors, and a considerable amount of cicatricial tissue excised. Dr. Sharpe kindly assisted me, and was able, by means of his finger through the mouth and a forceps pushed up from below, to push up the shrivelled epiglottis and to stretch the cicatricial contraction so that a rubber tube, No. 22 (F.), could be drawn upward. The remainder of the trachea was then opened and cleared of its cicatricial tissue, and the rubber tube laid in the new canal, its lower end, to which a string was attached, extending down to the opening in the trachea, and its upper end, to which also a string was attached, protruding out of the mouth. One suture of silk about the middle of the larynx drew its edges together and aided in retaining the rubber tube.

On December 18 chloroform was again administered, the tube removed, the new laryngeal and tracheal canal made still larger by excision of more cicatricial tissue, and after all hemorrhage had ceased, its interior, from the first tracheal ring to within half an inch of the glottis, was grafted by a Thiersch's graft taken from the thigh. This was rolled around a rod of gauze covered by rubber tissue, which was inserted with the raw surface of the graft against the bleeding surface of the new tracheal canal. The section grafted was about three inches in length. Through the glottis a silk thread was carried, emerging through the mouth. The graft "took" throughout its entire length, and on January 8, 1901, the anterior wall of the windpipe was formed by dissecting loose the skin edges of the wound and uniting them by suture in the median line, a soft rubber tube, size No. 22 (F.), being inserted, its lower end resting against the tracheotomy tube, and its upper end

projecting through the mouth, strings being attached to each end and fastened to the patient's neck and chest.

On January 10 the tube accidentally slipped out. It could not be replaced without chloroform. The wound healed kindly, and a new windpipe, comfortably carrying a tube of No. 24 (F.), was established. This tube was worn with an occasional change until April 16, when a tube of No. 28 (F.) easily replaced the smaller tube, and through this the boy could breathe comfortably. Its large size, and the fact of its being made of soft rubber, however, produced so much œdema of the glottis that it was decided best to replace it with a tube of No. 24 (F.), which was easily worn, and through this the boy breathed comfortably. Since April 10 an intubation tube has been worn, and through this respiration is comfortably maintained, the tracheal opening being closed by a pad of gauze. As there are no arytenoids or projections to maintain the intubation tube in place, it is occasionally expelled, and is sometimes not replaced for hours, during which time the boy breathes through his larynx. It is deemed wise, however, to insist on his wearing an intubation tube, at least intermittently, for some months longer, until all danger of recontraction of the glottis above the site of grafting has passed.

As is noted in the above history, in May, 1901, the boy returned to his home, a distance of some five hundred miles, wearing the intubation tube. Our intention was that in the course of three or four months he should return to the hospital for permanent removal of the tube. This plan, however, was not carried out, and he remained at his home wearing his intubation tube. The boy continued to gain in health, and the tracheotomy fistula grew smaller; he continued, however, to wear the intubation tube, as his father feared that the boy might suffocate were it removed. It was worn without discomfort until April 19, 1903, when, while taking active exercise, he made a sudden inspiration and the tube slipped down his trachea. He was immediately seized with a violent fit of coughing and became much cyanosed, struggling for breath. After a short time he regained his breath but continued to suffer from more or less dyspnœa as well as from attacks of coughing. On the following day (20th) he had some fever and suffered greatly from dyspnœa and cough. On the 21st he started for New York, his

temperature in the morning being 101°, pulse 120, and respiration rapid and labored. On his arrival at the hospital in the early afternoon his temperature was 104.5°; pulse, 144; respiration, 36. He looked extremely anxious, was markedly cyanosed, and was coughing almost incessantly, the expectoration being watery and blood-stained. Over the right lung the breathing-sounds were faint, with subcrepitant râles. With the fluoroscope there was seen some two inches to the right of the sternum and five inches below its intraclavicular notch, in the region behind the right nipple, the shadow of the intubation tube. The patient's condition was so urgent that immediate operation was demanded. A small amount of chloroform was administered through the tracheal fistula, which had become reduced to the size of a thin lead-pencil. This was situated at the third or fourth tracheal ring. A curved, heavy probe, passed downward through this opening, struck the intubation tube at the depth of six inches. The opening was enlarged three-quarters of an inch downward and attempts were made with curved laryngeal forceps and O'Dwyer's extractor to extract the tube. The attempts, however, failed, the tube being apparently lodged at the lower extremity of the first branch from the right bronchus. In order to secure better access, the trachea was split downward for another inch, well below the top of the manubrium sterni. Considerable hemorrhage occurred from the thyroid veins. A further attempt was then made with the laryngeal forceps, when suddenly there was a profuse flow of dark blood from the trachea, apparently caused by some change in position of the tip of the intubation tube and the resulting opening of a vein in the interior of the bronchus. The patient became intensely cyanosed and was almost drowned by his own blood. Artificial respiration was practised. The blood continued to pour out, and the patient's condition was exceedingly desperate. A fresh attempt ended happily, and the forceps extracted a large-sized tube, much rusted on its surface. Immediately the hemorrhage ceased, and the patient soon rallied. The trachea was sutured with silk, except for a space at the former fistula, where a tracheotomy tube was inserted. For several days following there was some bloody expectoration due to a localized pneumonia in the right lung. The condition of the boy, however, improved rapidly, and on May 6 the tracheotomy tube was removed, and a few days later the tracheal opening was contracted by adhesive

plaster, and in six weeks closed completely. Since May 25, 1903, the boy has breathed comfortably through his larynx, and in July he writes, "I am feeling fine; I can breathe through my throat as well as anyone." Later information confirms this good report.

The approach to a bronchus through the thoracic wall is attended with so many difficulties, and the results have been so disastrous, that in this case I preferred to split the trachea as far downward as possible and to trust to the extraction of the foreign body by means of forceps. The method resulted happily, but for a few moments the boy's condition was very desperate, and if the forceps had failed to seize the tube, death would have promptly resulted. This was mainly due to the hemorrhage, which apparently resulted from erosion of the wall of a vein by the pressure against it for some sixty hours of the tip of the tube. Such a hemorrhage is not ordinarily to be expected, and I should feel inclined in similar cases to adopt the same plan of treatment.

This case is also interesting on account of the gratifying result in the restoration of a larynx which was but a mere fibrous cord, enveloped by shrunken cartilages. The larynx now possessed by the boy is perfect as regards its respiratory function, and quite satisfactory as regards its function of articulation, for the boy can make himself clearly understood across a large room. The grafting of the interior of the larynx and upper part of the trachea with the skin-flaps from the thigh, has certainly been a most important factor in the accomplishment of this favorable result.